Magnetical, and Meteorological Observations made at the Government Observatory, Bombay

1890 – 1897

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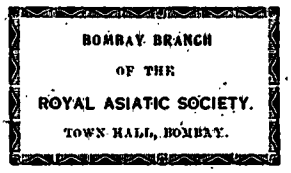

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MAGNETICAL AND METEOROLOGICAL OBSERVATIONS

MADE AT THE

GOVERNMENT OBSERVATORY, BOMBAY,

1890.

133500

WITH AN APPENDIX.

MAGNETICAL AND METEOROLOGICAL OBSERVATIONS

MADE AT THE

GOVERNMENT OBSERVATORY, BOMBAY,

IN THE YEAR 1890

UNDER THE DIRECTION OF

CHARLES CHAMBERS, Esq., F.R.S.,

TOGETHER WITH AN APPENDIX CONTAINING AN ACCOUNT OF A MAGNETIC RESEARCH.

Printed by Order of Her Majesty's Government

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1892.

TABLE OF CONTENTS.

PAGE

INTRODUCTION TO THE METEOROLOGICAL AND MAGNETICAL OBSERVATIONS, 1890.

Thirtieth number of the series ... i.
Geographical position of Observatory ... id.
Local situation ... id.
Directorship of the Observatory ... id.
Observatory Establishment ... id.
System of observation and reduction and distribution of duties ... ii.
Eye-observations subsidiary to continuous registrations of automatic instruments ... iii.
Instruments and phenomena observed five times a day ... id.
Other routine operations ... iv.

REMARKS ON THE CONDITION AND ADJUSTMENTS OF THE INSTRUMENTS AND ON THE PROCESSES OF REDUCTION ... id.

I.—METEOROLOGICAL INSTRUMENTS, 1890.

BAROMETER, description of ... id.
Error in setting the zero point of the scale, and change of method of observation ... v.
Corrections applied to the observed readings ... vi.
Comparison with the Kew Standard Barometer ... id.

GROUND THERMOMETERS ... vii.

THE ROBINSON-BECKLEY ANEMOGRAPH, description of ... id.
Tabulation of Anemograms ... viii.
Method of reduction ... id.

NEWMAN'S RAIN GAUGE ... ix.

BAROGRAPH AND THERMOGRAPH ... x.

PRESSURE OF VAPOUR.

Pressure of Vapour and additional capacity of the Air ... id.
Table I.—Regnault's values of the Pressure of Vapour at different Temperatures ... id.

SELF-REGISTERING RAIN GAUGE ... xi.
New syphon of modified form ... id.
Constants for converting syphon discharges into inches of rain-fall ... id.
Measurement and distribution of syphon discharges ... id.
Determination of scale of rain-fall ordinates ... xii.

DESCRIPTION OF THE TABLES OF METEOROLOGICAL RESULTS AND OF THE PROCESSES OF REDUCTION, 1890.

Barometric Pressure ... id.
Temperature of the Air, &c. ... id.
Monthly and annual range of variation of Meteorological Elements ... xiii.

NOTES ON INSTRUMENTAL CHANGES AND ON ALL IRREGULARITIES OR DEPARTURES FROM THE ROUTINE OF OBSERVATION OR REDUCTION, 1890.

Robinson-Beckley Anemograph ... id.
Barograph ... xiv.
Thermograph dry-bulb ... id.
Thermograph wet-bulb ... id.
Self-registering Rain Gauge ... id.

II.—MAGNETICAL INSTRUMENTS, 1890.

Kew Absolute Declinometer and Deflection and Vibration Apparatus ... id.
Kew Dip Circle ... xv.

Tables of Results derived from the Continuous Registrations of Automatic Meteorological Instruments and from Meteorological Observations, 1890.

		1890. Table.	Page.
Daily Means of	Barometric Pressure	I	2
	Temperature of the Air	II	3
	Pressure of Vapour	III	4
	Additional Capacity of the Air	IV	5
Individual observations in each Month of the Year, which showed the greatest and the least values of the following elements, *viz.*, Height of Barometer, corrected for Temperature; Temperature of Air; Pressure of Vapour; and Additional Capacity of Air		V	6
Daily.	Total Fall of Rain (in inches) as measured by F. Chambers's Self-registering Gauge, the funnel of which is 28 feet above the ground	VI	7
Mean Velocities of the North or South and East or West Components of the Winds which blew on each Day of the Year		VII	8
Mean Velocity of the Wind, in miles per hour, without regard to the direction from which it blew for each day of Bombay Civil Time; also the Mean Monthly Velocity, and its Variation from the Mean of the Year		VIII	9
Sums of the Velocities, and the Mean Velocities, in miles per hour, of the Winds which blew in each Month, from each of the sixteen Principal Directions; and also the number of observations which those sums comprise; the latter numbers indicating the Relative Frequency of the same Wind (as to direction) in the several months, and of different Winds during the same month		IX	10

Tables of Results derived from the Meteorological Observations made daily at 6, 10, 14, 16 and 22 hours, 1890.

	1890. Table.	Page.
Monthly Mean Temperature of the Ground, and its Annual Variation, at the respective depths of 1, 9, 20, 60 and 132 inches below the surface	X	12
Extent of Cloudy Sky—mean of estimations made at 6, 10, 14, 16 and 22 hours daily, the whole sky being reckoned as 10	XI	13
Daily. Total Fall of Rain (in inches) as measured by Newman's Gauge, placed 4½ feet above the ground	XII	14
Five-Day Means, 1890	XIII	15
Annual and Lustral Means, 1890	XIV	16

Tables of Results of Absolute Magnetical Observations, 1890.

	1890. Table.	Page.
Observations of Vibration and Deflection, taken with the Kew Unifilar Magnetometor (No. 23, by Elliot Brothers), for the determination of Absolute Horizontal Force	I	(3)
Observations of Absolute Declination	II	(6)
Observations of Inclination, taken with Barrow's Dip Circle, with Microscopes, No. 49 and two 3½-inch Needles	III	(7)
Supplementary Observations of Inclination, taken with Barrow's Dip Circle, with Microscopes, No. 49 and two 3½-inch Needles	III *a*	(10)
Appendix.		

INTRODUCTION

TO THE

METEOROLOGICAL AND MAGNETICAL OBSERVATIONS,

1890.

Of the series of books entitled "Bombay Magnetical and Meteorological Observations" the present one is the thirtieth, extending the record, which before embraced the years 1845 to 1889, up to 1890.

2. The latitude and longitude of the Colába Observatory are 18° 53′ 45″ North and 72° 48′ 56″ East respectively.

3. *Local situation.*—The Observatory is situated at the extremity of a narrow strip of land extending two miles to the south-westward of the Fort of Bombay and separating the harbour and Back Bay. Trap rock, which is very abundant in the ground near and on the surrounding sea-beach, crops up at many places through the red sandy soil which covers the greater part of the Observatory enclosure. During the rainy months of the year, the soil is overgrown with grass, which, however, is quickly burned up when the dry season comes round. The nearest elevated ground is Malabár Hill, which lies on the opposite side of Back Bay, at a distance of four miles, but that which subtends the largest vertical angle, as seen from the Magnetical and Meteorological Observatory, is the southern hill of the Island of Karanja, at a distance of about eight miles across the harbour. The altitude of the highest point of the latter is less than 1° 7′. An idea of the aspect and nature of the surrounding country, and of the exposure of the thermometer shed and anemograph, may be obtained by inspection of the photographs—forming a series of panoramic views all round the compass, together with some near views of the buildings and instruments—which accompanied the "Meteorology of the Bombay Presidency" published in 1878. In the same work will be found a plan of the grounds and buildings of the Observatory, and an index showing the names and uses of the several buildings, and the location of trees of large and small growth.

The buildings concerned with the production of the observations recorded herein are, (1) the Astronomical Observatory and the Anemometer Tower, with a western wing, the greater part of which serves as a computing room, whilst the remainder is partitioned off for a photographic operating room; (2) the Magnetical Observatory with the adjoining Electrometer Tower; (3) the underground Magnetograph room; and (4) the Thermograph Shed, enclosing the thermograph room; to which may be added the old thermometer shed.

4. *Directorship of the Observatory.*—The observations of the year 1890 were taken under the direction of Mr. Charles Chambers, F.R.S.

5. *Observatory Establishment.*—In the Magnetical Department of the Observatory there are one First Assistant, one Second Assistant, three Observers and one Computer; and in the Astronomical Department one First Assistant

and one Second Assistant. These several offices were filled, during the year 1890, in the manner exhibited in the following statement:—

Name of Officer.	Department.	Name of Office.	Initial.
Vinayek Narayen Nene ...	Magnetical	First Assistant ...	V. N.
Crishnaji Ganesh Thakur...	Do.	Second Assistant .	C.
Ganesh Sadashiv Joshi ...	Do.	Observer ...	G. S. J.
Narayen Sakharam Kelker	Do.	Do. ...	N.
Damodar Waman Sathaye	Do.	Do. ...	D.
Shitaram Vithal Bendarker	Do.	Computer...	S.
Parsharam Laxuman Datar	Astronomical	First Assistant ...	P.
Vithal Govind Ghaneker...	Do.	Second Assistant .	V. G. G.

The initials marked in the last column are those which the respective observers attach to the several observations made by them.

6. *System of observation and reduction and distribution of duties.*—The Astronomical Observatory is furnished with a transit instrument and a sidereal clock, which are used for the determination of local time, primarily for communication to the shipping in the Bombay harbour, and secondarily for communication, by comparison of chronometers three times a week, to the Magnetical and Meteorological Observatory.

Magnetical and meteorological observations are taken and entered in the registration forms every day, without exception, at the hours 6, 10, 14, 16, and 22,—the day commencing at midnight at Bombay (Colába) and being reckoned from 0^h to 24^h. One observer (called the morning observer) takes the 6^h observation, a second one (the day observer) those of 10^h, 14^h and 16^h, a third one (the night observer) that of 22^h, and a fourth is relieved from observing duty for one week; the next week the four observers change round in circular order, and so on week by week. On Sundays and general holidays special arrangements are made to set free all but three members of the staff—one being kept on observing duty, one in charge of photographic instruments, and one in charge of the Astronomical Observatory. All the observers reside on the premises, and they are required to keep a general out-look on the weather during the intervals between their respective hours of observing duty and the next earlier observation hours. Each observer reduces his own observation immediately after the entry of the observation in the register, and the reductions are checked by the observer who next comes on duty: amongst the duties of the day observer are included the calculation of daily averages, and the writing out of the monthly abstracts. These latter consist of tables having the days of the month marked in numerical order in the first column and the hours of the day in order at the head of the columns, and there is one for each magnetical or meteorological element observed. Attendance in the computing room is exacted of the observers, when not actually engaged upon observing duty, as well as of the First Assistant, Magnetical Department, Second Assistant, Astronomical Department, and Computer, for six hours daily, exclusive of a break for rest in the middle of the day. Upon the First Assistant devolves the immediate oversight of general observing, computing and photographic operations. The observations of absolute declination, horizontal intensity, and dip, which are repeated once, twice and four times respectively every week, are distributed amongst the more experienced observers in such a manner that no two consecutive weeks' observations should, as a rule, fall to the same observer. The time of one Assistant is almost entirely absorbed by the photographic operations, the instruments requiring vigilant attention, and the chemical processes demanding much skill and care.

The anemograph is in charge of the Second Assistant, Astronomical Department, who changes the recording paper daily, and tabulates the hourly readings of direction and movement of the wind. The tabulations are checked by the Photographer, between whom and the Second Assistant, Astronomical Department, are divided also the resolution of the tabulations into components and the writing out and checking of wind abstracts, the one performing a set of operations and the other checking them, and so on alternately. The correspondence of the direction record to the actual direction of the vane is frequently checked by turning the instrument to point to the Kennery Lighthouse, the azimuth of which is accurately known. In order to preserve the direction gear in smooth working condition, the fixed toothed wheel is cleaned and oiled—without stopping the instrument—once a week; and every day the direction vane is turned right round the compass once each way, with the object of lubricating both sides of the teeth of the wheel.

All computing operations are systematically performed by one computer and checked, by a repetition of the operation, by another.

7. The eye-observations that are taken five times a day are subsidiary to continuous registrations obtained by means of automatic recording instruments. Of these there are five sets of apparatus,

I. The magnetographs,
II. The barograph,
III. The thermograph,
IV. The pluviograph, and
V. The anemograph,

of which IV is an appendage of III, designed to work with the same light and to trace its curve on the same sheet of sensitive paper. The first four register photographically and the last mechanically.

8. *Instruments and phenomena observed five times a day.*—These are as follows:—

Extent and description of clouds, state of the weather, occasional phenomena, and direction of the wind.	From 5 minutes before to 2 minutes after the exact hour.
Thermograph standard thermometer, dry bulb Do. do. wet bulb	At 2 minutes after the exact hour.
Newman's rain gauge (in wet season)... ...	„ 3 „ „
Thermometer in ground 1 inch deep... ... Do. do. 9 inches deep ...	From 5 to 7 „
Newman's standard barometer No. 58 and attached thermometer. Do. do. No. 48 ditto.	„ 7 to 9 „
Grubb's declination magnetometer	At 12 „ „
Grubb's horizontal force magnetometer and its thermometer	„ 14 „ „
Vertical force magnetograph and its thermometer...	„ 17 „ „
Declination magnetograph	At 18 minutes after the exact hour.
Horizontal force magnetograph and its thermometer	„ 19 „ „
Thermometer attached to barograph ...	„ 20 „ „

The vacuum gauges of the magnetographs are read at 10 hours only, the maximum and minimum thermometers in the magnetograph room are read and re-set at 10 hours only, and the 20 inches, 60 inches and 132 inches deep ground thermometers are read at 14 hours only.

Newman's rain gauge is read daily at midnight in the wet season, and the discharges of the syphon of the self-registering rain gauge are read once a day or oftener as required.

9. *Other routine operations.*—(1) The anemograph is supplied with fresh recording papers daily.

(2) Fresh sensitive papers are put upon the recording cylinders of the three magnetographs, of the barograph, and of the thermograph and pluviograph every two days. The papers taken off are developed, fixed and washed, and new ones are prepared by the photographer on alternate days.

(3) The tabulation of anemograms is effected as soon as the papers are available, generally, that is, on the day following that to which the record refers. Barograms, thermograms and horizontal force magnetograms also are regularly tabulated as soon as the registers are available.

(4) Double sets of observations of vibration and deflection are made with the unifilar magnetometer for the determination of the absolute horizontal force weekly, and with the same instrument observations of absolute declination are also made weekly.

Observations of magnetic dip are made four times a week.

The times of vibration of Grubb's declination and Grubb's horizontal force magnetometers are observed once a year; but each of the magnets is disturbed through a large arc (yet less than 1°) once a month, and the nearness of its return to the undisturbed position is recorded.

(5) Transit observations of stars for the determination of time are made generally on Mondays, Wednesdays and Fridays in the dry months: during the monsoon no opportunity is lost of observing the sun or stars when visible. The adjustment of the transit instrument is frequently tested by reference to the fixed collimator mark; the collimation, level, and azimuthal errors are determined from time to time, and whenever the collimator shows a displacement of the telescope, or any considerable discordances appear in the clock errors derived from observations of stars of different north polar distances.

Remarks on the Condition and Adjustments of the Instruments and on the Processes of Reduction.

10. The object of the following description is to make known such special circumstances in connection with the condition, situation and adjustment of the instruments, with the habits of the observers, and with the routine of the processes of reduction, as are necessary to enable the reader to form an independent judgment of the degree of precision attained, and of the weight to be attached to any conclusions that may be drawn from the observations.

I.—METEOROLOGICAL INSTRUMENTS, 1890.

Barometer.

11. *Description.*—The observations which furnished the fundamental data for the construction of the tables of barometric pressure for the year 1890 were taken with a standard barometer by Newman, marked No. 58, the same which has been used uninterruptedly since the establishment of the Observatory. The internal diameter of the barometer tube, marked by the maker on the frame of the

instrument, is 0·530 inch. The scale, which is of brass, is moveable, and terminates below in an ivory point which is designed to be set, at each observation, so as just to touch the surface of the mercury in the cistern, and the setting is known to be accurate when the point appears just to meet its image reflected from the mercury. The upper part of the scale, which is divided to twentieths of an inch, has a vernier with slow motion screw, reading to thousandths of an inch, and to it are attached two small brass plates with horizontal lower edges before and behind the tube: the setting of the instrument consists in raising and lowering the vernier until the horizontal plane containing these two edges is tangent to the surface of the mercury in the tube of the barometer, and this is the case when it is just so low, and no lower, that when the eye is raised or lowered no light is seen to pass between the central part of the mercurial surface and the two edges. A thermometer with a cylindrical bulb dipping into the mercury in the cistern is attached to the barometer, and is intended to be read at every observation: but an investigation described in the "Bombay Magnetical and Meteorological Observations, 1871-78," Introduction, pages xlii to xlv, showed that the errors of this thermometer—as measuring the temperature of the mercurial column—were considerable, and since the end of 1884 its use has been discontinued: in lieu of it a thermometer by Murray and Heath (No. 2) divided to half degrees, and with its bulb immersed in a column of mercury held in a glass tube of nearly the same diameter as that of the barometer, was fixed on one side of the metal frame of the barometer at about the same height as the middle of the barometric column, and this has been regularly observed since 1885·0. The error of the new thermometer varies by about a quarter of a degree within the annual range of the temperature of the barometer No. 58, and in adopting a mean error throughout small pressure corrections of $\pm$ ·0003 are disregarded.

The standard barometer is attached by means of brackets to a flat board which hangs against the wall on the eastern side of the Magnetical Observatory, near the north-east corner of the room, and its cistern has an elevation of 37 feet above the mean sea level at Colába. It was lifted down in May 1866 and the mercury carefully caused to run up to the top of the tube, where it gave the sharp metallic stroke that is indicative of a good vacuum. It is stated in the "Report of the Committee of Physics of the Royal Society, 1840," page 56, where a description is given of a class of barometers of which this is an individual, that the scale is laid off from the zero point from an authentic standard. The tube of the barometer is kept in proper adjustment to verticality.

12. *Error in setting the zero point of the scale, and change of method of observation.*—In the long period that has elapsed since the instrument was mounted (in 1841) there has been a gradual accumulation of scum on the surface of the mercury in the cistern, and the glass cistern became more and more opaque until the reflected image of the ivory zero point of the scale was very obscurely seen, so that the operation of setting the zero of the scale was uncertain to a very sensible degree. For this reason, the method of observation which had always previously been in accordance with the above description, was changed on the 22nd May 1866, so as to avoid the necessity of setting the scale at every observation. The scale was set once for all on that day and the setting screw then removed; and suitable corrections were thereafter applied for the rise and fall of the mercury in the cistern. These were taken from a table calculated by the formula*

$$\text{Capacity correction} = \cdot 04321\ (h - 29\cdot 943)$$

where h_0 represents the uncorrected reading of the barometer. As the departure of the barometer reading from its mean value very rarely reaches 0·4 inch,

* The data for the construction of this formula will be found in the "Bombay Magnetical and Meteorological Observations, 1865 – 70," Introduction, pp. x, xi.

which would require a correction of only ·017 inch, it is very improbable that an error of so much as ·001 inch ever occurs from inaccuracy in the adopted value of the relative capacities of the tube and cistern. Since the change was made, the comparability of the observations for showing variations is, therefore, throughout much better secured.

13. *Corrections applied to the observed readings.*—It was stated in the instructions given in the Report of the Committee of Physics (page 56) that the correction for capillary action in barometers of this description is rendered inappreciable by the large diameter of the tube, and consequently no correction for capillarity has ever been applied. Besides the correction for capacity, two others only have been applied; one, invariably from the first, for reducing the observations to what they would have been if the temperature of the mercury had always been 32° Fahr. and that of the brass scale 62° Fahr., and the other, since 1885·0, to remove the discontinuity that would otherwise have been produced in the records by the change of thermometers: the first was taken from Table II. of the Committee's Report, and the last was a constant reduction of the corrected pressure by ·002 inch. The considerations on which the latter correction was based are as follows: (1) the tabulations of the barograph are known to exhibit correctly the diurnal variations of barometric pressure, free from any sensible influence of variations of the temperature of that instrument;* (2) the mean of twenty-four hourly barograph tabulations on any day is taken to correspond to the mean of the same twenty-four hourly pressures observed with Newman's barometer No. 58 and corrected for the temperatures indicated by the old attached thermometer; (3) it does not follow that the mean of the tabulations for the five observation hours (6, 10, 14, 16 and 22) will then correspond exactly to the mean of the observed pressures for the same hours, because the old thermometer does not indicate precisely the actual variations of temperature of the mercurial column: in fact the latter mean pressure was, on the average of all the observation days of the year 1872, ·0008 inch in excess of the former mean pressure; (4) nevertheless the correspondence for the five observation hours was adopted as near enough to identity with the correspondence for the twenty-four hours, and the recorded mean pressures of the years 1873 to 1884 will thus be ·0008 inch in excess of those of the years before 1873; (5) the old attached thermometer and the thermometer No. 2 by Murray and Heath were read together at the five observation hours throughout the year 1883, and the average excess of the former reading over the latter was found to be 0°·62; (6) hence to make the pressures reduced for the readings of Murray and Heath No. 2 correspond to those reduced for the readings of the old thermometer the former pressures must be decreased by ·0027 × 0·62 = ·0017, or—as the pressures are read and calculated only to thousandths of an inch—by ·002 inch. Thus taking the period before 1873·0 as a standard period, the recorded annual mean pressures of the years 1873 to 1884 will be ·0008 inch too high, and those of 1885 and later years ·0005 inch [= —·0020 + ·0017 + ·0008] too high.

14. *Comparison with the Kew Standard Barometer.*—Indirect comparisons of Newman's barometer No. 58 with the Kew standard have been made through the mediation of two mountain barometers by Negretti and Zambra, numbered 705 and 711: in Bombay these were both found (in July 1876) to read ·011 inch higher than Newman No. 58, whilst in England they had been found to be ·007 and ·006 inch respectively above the Kew standard: hence Newman's No. 58 reads on the average ·004 inch below the Kew standard. It happens that this is exactly the average amount by which the readings of Newman's barometer have been over-reduced for temperature (*see* Introduction to volume for 1871 to 1878, paragraph 72).

*See "Bombay Magnetical and Meteorological Observations, 1871-78," Introduction, pages xxxvii to xlvi.

Ground Thermometers.

15. Thermometers with their bulbs at the respective depths below the surface of the ground of 1, 9, 20, 60, and 132 inches are regularly observed, the two former five times a day and the three latter once a day at 14 hours. They are all by Newman, of London, and are divided on brass scales, and the value of one division, approximate range of part of scale exposed above ground, and lengths of that part and of one average degree are shown below for each thermometer:—

Depth of Bulb.	Divided to	Approximate Range of exposed part of Scale.	Length of that Range.	Average length of 1°.
Inch.			Inches.	Inch.
1	1°	30° to 145°	8·19	·071
9	0°·2	70° to 115°	5·20	·116
20	1°	35° to 160°	6·73	·054
60	1°	35° to 160°	6·81	·054
132	1°	50° to 140°	6·44	·072

The 1-inch and 9-inch thermometers are on flat brass scale frames, which lie against wooden posts in the ground, and they have their bulbs in contact with the loose red earth which fills the holes in which they are placed; the 20-inch, 60-inch, and 132-inch thermometers have their lower parts enclosed in brass tubes with ends curving off to a point, and the upper parts are in wooden box frames, to which the brass scales are fixed. The reason why only one observation is made daily of the three deeper thermometers is, that it had been found by hourly observations in 1849, 1850 and 1851, that no appreciable diurnal variation of temperature reached the depth of 20 inches.

The errors of graduation of the ground thermometers are unknown.

The Robinson-Beckley Anemograph.

16. *Description.*—From the beginning of the month of June 1867 was brought into use an anemograph of the kind designed by Dr. Robinson, with improvements by. Mr. Robert Beckley, and it remains in action to this day. It was made by Mr. R. W. Munro, and was supplied through the Kew Committee of the British Association, after being tested at the Kew Observatory. In this instrument the arrangements for the registration both of movement and direction of the wind are mounted on one shaft, and the registrations are made on a single sheet of paper, which is changed daily. The essential part of the apparatus for measuring the movement is a vertical spindle, to which cross arms are attached at the top, carrying four hemispherical cups of copper. The cups are attached to their several arms, so that, looking from the central axis, their convex sides are seen turned to the right hand, and the wind, acting with greater effect upon the concave than on the convex sides of the cups, causes the system to rotate in a right-handed direction. It is the number of these rotations, 140 of which are reckoned to a mile of movement of the wind, that tells us how fast the wind has been blowing; and the number is reduced, by means of wheel-work, 7,000 times before reaching a small cylinder, carrying a brass spiral pencil that traces the movement on the registering paper; this latter is metallic paper of the kind used for pocket-books, and is wrapped round a brass cylinder, which is kept rotating by clockwork, and as the paper passes under the spiral pencil, which presses slightly upon it, the black movement trace is received upon it. The wind vane, which consists of a pair of windmill vanes with connecting spindle having an endless screw in the middle, and gearing into a fixed horizontal toothed wheel, is attached to a tube that surrounds the lower part of the vertical movement spindle; to the bottom of the tube is fixed a toothed wheel, which, in communication with other such wheels, conveys the motion of the vane *unchanged* to a small cylinder with spiral pencil, which traces the changes of direction on the register;

and it is so arranged that the movement and direction are traced on parallel strips or bands of the same sheet of paper. The heavy parts of the instrument—the direction vane and appendages, and two long brass tubes which connect the instrument proper with the recording apparatus—are supported on friction balls which run in grooves partially filled with oil, thus reducing the friction to a minimum. The instrument is erected on the old Time Ball Tower, at a height of 53 feet above the ground, and 95 feet above the mean sea level, over a platform 12 feet in diameter, which is designed to give ready access to the instrument, and to protect it from irregular currents of wind, glancing from the convex surface of the dome; and it is supported outside by a fixed cast-iron standard, to which is attached, at the top, the toothed wheel, into which the endless screw of the spindle connecting the windmill vanes gears. The centres of each pair of opposite hemispherical cups are four feet apart, and three and a half feet above the platform, and the diameter of the cups is nine inches. The diameter of the vanes is 15 inches, and the breadth of the fans four inches. The register form is printed in red, with lines dividing its length into hour spaces; and its breadth, on the movement side, into five spaces, each representing 10 miles of movement of the wind, and numbered from 0 to 50 miles; and on the direction side into spaces corresponding to 11¼ degrees on each side of the 16 principal directions N N.E., N.E., &c.....N.N.W., N., which spaces are numbered consecutively 1, 2, &c..... 15, 16.*

17. *Tabulation of Anemograms.*—Numerical tabulations have been made of the movement and direction of the wind during the interval between every two successive hours in the following manner:—the number of miles indicated at the point where the velocity trace cuts a horizontal hour-line being read for two successive hours, the excess of the latter over the former reading (adding 50 if the trace has passed over from left to right of the form) gives the movement for the interval; and the number of the space in which the direction trace lies during the interval is entered as representing the direction. The estimations of movement are made only to the nearest full mile. Should the direction trace not lie all in one space during the whole interval of an hour, then if the change of direction exceed 90° or eight points, the whole observation for that hourly interval is rejected; but if it lie within that limit, the direction is estimated—by an inspection of the movement and direction traces together—whence the aggregate flow of air was the greatest, and this direction is adopted for the full hour. On the average of the years 1871 to 1883, out of 8,754 hours during which the instrument was in action, 3 only had to be rejected, because the direction of the wind varied more than eight points within the hour.

18. *Method of reduction.*—Hitherto we have had to speak of phenomena liable only to simple increase and decrease of value, and not subject to any change of quality. Such phenomena being properly and completely evaluated by simple numbers, we may apply to the numbers any arithmetical operations, such as averaging, and infer from the results of those operations corresponding properties of the phenomena. But we have now come to a phenomenon which requires two numbers to express it, one representing its amount and the other a varying quality; the first referring to the velocity, and the last to the direction of the wind. Here we may no longer apply arithmetical processes directly and indiscriminately to the observed numbers: but, the subject being one of motion, we must treat them according to the principles of the science of motion. These principles tell us that the motions may be equally well expressed by means of two varying numbers referring to two invariable qualities, as by a varying number referring to a varying quality; and they show us how to obtain either form of expression from the other. The invariable qualities chosen in the present case are the directions north and east, the actual wind blowing in

* A more detailed account of the Colába anemograph will be found in the "Bombay Magnetical and Meteorological Observations, 1865 to 1870," Appendix I., page 199.

each hour being resolved into north and east components, which may be regarded separately as the velocity of the wind in the invariable direction north or south, and the velocity of the wind in the invariable direction east or west. The resolutions are effected by means of the formulæ :—

$$\text{North component of velocity of wind} = m \cos (n \times 22\tfrac{1}{2}^\circ),$$
$$\text{East component of velocity of wind} = m \sin (n \times 22\tfrac{1}{2}^\circ),$$

where m is the movement observed, and n the number of the direction space under which the wind of the hourly interval is classed. When the sign of either of these calculated quantities is negative, it implies that the wind blows from the opposite direction, *i. e.* from south or west. The calculations are readily made by means of tables to the nearest tenth of a mile of velocity per hour. Having now substituted the two equivalent winds for the real one, we may with propriety proceed to combine together numbers of observations by algebraical addition and averaging, treating the north and east components of the wind each by themselves. The averages thus found from the observations of any given period will represent the velocity with which the wind must blow from the northward (from the southward if the sign of the average be negative) continuously for the whole period, in order that the total movement of the wind from that direction may be the same as the total movement from the same direction produced by the winds which actually blow, and similarly the velocity with which it must blow continuously from the eastward (westward if the sign of the average be negative).

No corrections have been applied to the anemograph tabulations on account of friction.

Rain Gauge.

19. *Newman's Rain Gauge.*—This instrument is made of copper, and exposes for the collection of rain-drops a circular surface of an average diameter of 12·035 inches, forming the top of a funnel, that carries the rain into a cylindrical vessel below, having a diameter of 5·732 inches : a float of slightly less diameter, so as to rise and fall freely, rests upon the water in this vessel, and having a wholly convex external surface, it allows the rain as it falls to flow off and raise the level of the water and with it the float; to the middle of the float is fixed a wooden rod, graduated with divisions, each of which represents ·05 inch of rain; and the readings of this scale, which are easily estimated to fifths of a division, are made where it is cut by the upper edge of a light brass rod placed horizontally across the mouth of the funnel, but half an inch below the edge of the exposed circular surface; the scale passes through a hole in the middle of the horizontal rod, and is thus kept always in a vertical position. The range of the scale is from 0 to 4·00 inches, and the readings of the scale have been entered in the meteorological register and the differences been taken for every interval between successive observations : the rain has accumulated in the vessel generally till the reading was somewhere above 2·00 inches, when the water was let out, by means of a brass cock at the bottom, till the reading came down to 0·00 inch. This latter reading was also maintained during intervals of dry weather—when, from evaporation, the scale would otherwise have fallen lower—by pouring small quantities of water into the gauge : the reason of this is obvious, as, if some water were not always retained, the float would sometimes rest on the bottom of the vessel and so cease to perform its function of rising equally for equal increments of rain. The scale on the wooden rod was graduated so as to agree approximately with the data—the diameters of the gauge and measuring vessel—given above. The error of the scale according to which the rod was graduated was less than a thousandth of the whole.

Newman's gauge stands on a large rectangular block of stone, in a position intermediate between the Entrance Gate, the Magnetical Observatory, and the Thermograph Shed, where the altitude of the highest neighbouring object, as seen from the gauge, is about 30°. It is supported by three feet, which are embedded with lead in holes cut in the stone block, and its circular mouth is at a height of 4½ feet above the ground and about 35 feet above the mean sea level.

Barograph and Thermograph.

20. Like the anemograph, the Colába barograph and thermograph were supplied through the Kew Committee of the British Association, after being tested at the Kew Observatory; and they are of like construction with those adopted by the Meteorological Committee of the Royal Society for the seven observatories established by them in the year 1867 in the United Kingdom. An account of these instruments in general, with notes on the peculiarities of the Colába set and on special points in the Colába arrangement of them and utilization of their registrations, will be found in the 1871—78 volume of this series, Introduction, pages xvi to xlvi.

21. *Thermograph.*—The height of the bulbs of the thermometers above the ground is 10 feet. The cage is placed on one of the most exposed parts of the Observatory grounds and away from any building: it is, however, screened, as well as the thermograph room in which the recording apparatus is placed, by a roomy shed with a planked roof that is everywhere 2 feet above the roofs of the cage and room: the sides of the shed are of the louvre construction on an enlarged scale, with double sheets of zinc enclosing a thick layer of felt substituted for the wooden laths, and with a vertical distance from lath to lath of one foot: the lowermost two feet of the sides are guarded simply by horizontal iron rods: the roof of the shed is covered with thick felt and then with strong canvas, and the whole of the exterior—sides and roof—is painted or limewashed white.

Pressure of Vapour.

22. *Pressure of Vapour and additional capacity of the Air.*—Having obtained from the tabulations of the barograms and thermograms hourly values of barometric pressure, temperature of the air, and temperature of evaporation, the pressure of vapour was calculated for each hour with the aid of a table by the formula

$$f''=f'-\cdot01147\,(t-t')\times\tfrac{P-f'}{30}$$

in which t and t' denote the temperatures of the air and wet bulb thermometers respectively, f'' and f' the pressure of vapour at the temperature of the dew point and at temperature t', and P the barometric pressure. The values of the pressure of vapour at different temperatures were taken from the following table, the numbers in which have been extracted from Boileau's Collection of Tables:—

Table 1.—*Regnault's values of the Pressure of Vapour at different Temperatures.*

Temperature.	Pressure of vapour.	Temperature.	Pressure of vapour.	Temperature.	Pressure of vapour.	Temperature.	Pressure of vapour.	Temperature.	Pressure of vapour.	Temperature.	Pressure of vapour.	Temperature.	Pressure of vapour.	Temperature.	Pressure of vapour.
°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.
35	·204	43	·278	51	·374	59	·500	67	·662	75	·868	83	1·128	91	1·455
36	·212	44	·288	52	·388	60	·518	68	·685	76	·897	84	1·165	92	1·501
37	·220	45	·299	53	·403	61	·537	69	·709	77	·927	85	1·203	93	1·548
38	·229	46	·311	54	·418	62	·556	70	·733	78	·958	86	1·242	94	1·597
39	·238	47	·323	55	·433	63	·576	71	·758	79	·990	87	1·282	95	1·647
40	·248	48	·335	56	·449	64	·596	72	·784	80	1·023	88	1·324	96	1·698
41	·257	49	·348	57	·466	65	·617	73	·811	81	1·057	89	1·366	97	1·751
42	·267	50	·361	58	·482	66	·639	74	·839	82	1·092	90	1·410	98	1·805

To find the additional capacity of the air the pressure of vapour was deducted from the number in the above table standing opposite to the temperature of the air.

Self-registering Rain Gauge.

23. A description of this instrument also will be found in the Introduction to the "Bombay Magnetical and Meteorological Observations, 1871 to 1878," page xlvi. In 1890 the syphon discharges were received in glass bottles and measured by means of a graduated glass tube and a marked glass bottle holding exactly half an inch of rain.

24. It was mentioned in former years that the occurrence of the discharging action of the syphon was occasionally liable to some uncertainty—the water at times trickling over the bend of the tube in considerable quantities before the proper discharge commenced. After trial of many modifications in the form of the syphon one was at last hit upon, which is free from this fault, and by which the tube is, moreover, kept in a satisfactorily clean condition from beginning to end of the monsoon, simply by the washing that takes place in the ordinary automatic discharges. Since November 1884, when the new syphon was brought into use, the discharges have been regular and unfailing except on two occasions, *viz.*, on the 18th June and 5th November 1890 when trickling again occurred: this was traced, in the last case, to the presence near the bend of the syphon tube of a living cockroach. To prevent this from occurring again, a lid of zinc was fitted to the discharge pipe at its entry into the receiving bottle, so as to cover the mouth of the bottle.

25. To prevent birds alighting upon the funnel, and choking it with their droppings, a conical arrangement of pointed iron spikes surrounding the funnel was attached in 1882, and was found to be effective.

26. *Constants for converting syphon discharges into inches of rainfall.*—As the surface exposed by the rain gauge funnel is 50·286 square inches, an inch of rain contains 823·955 cubic centimeters. With the aid of a cubic centimeter measure,* 412 cubic centimeters of water were poured into a narrow-necked glass bottle, and a file mark was made on the bottle neck at the level up to which the water rose. A glass tube was also graduated by means of the same cubic centimeter measure, so as to read off thousandths of an inch of rain with ease. The bottle is filled as often as there have been discharges from the rain gauge syphon, and the final excess or defect is measured with the graduated tube. The use of the bottle began on 31st July 1879 and continued till the 26th July 1884, when it was accidentally broken. An exact copy of it, which had been prepared beforehand, was then substituted for the original bottle, and this copy is still in use.

27. *Measurement and distribution of syphon discharges.*—The discharges are measured daily, or oftener during heavy rainfall, and are of course always of an integral number. For each measurement the average value of a discharge is attributed to each of the intervals of time, shown on the rain curve, between pairs of successive discharges; and it remains then only to distribute this quantity, for each filling of the receiving vessel, by means of tabulations of the ordinates of the rain curve. When, as is often the case, the rate of fall of the rain at the time of a discharge exceeds 1½ inch per hour, it is necessary to allow for the rain that enters the receiving vessel during the known time (16 seconds) of discharge, the allowance depending on the rate of rainfall, which is easily estimated for this purpose by noting, with the aid of an appropriate paper scale, the inclination of the rain curve immediately after the time

* Lent by Mr. F. Chambers, whose verification data show it to be accurate to a thousandth of the 100 cubic centimeters which it is designed to measure.

of discharge. The aggregate of such allowances is deducted from a day's (or other) measurement before dividing the quantity equally amongst the several intervals.

28. *Determination of scale of rainfall ordinates.*—The factor for converting ordinates of the rainfall curve into inches of rainfall was found by experiments in which a determined weight or volume of distilled water was poured into the receiving vessel, and the change of length of the ordinate produced thereby was carefully measured. In an experiment made on the 30th May, 1890, the quantity of water poured into the vessel was equivalent to ·480 inch of rain, and the change of length of the ordinate ·480 of a true inch; whence the factor is found to be 1·000, which is applicable to all the rainfall registrations of the year 1890.

29. The tabulations are made with the true-inch scale of the thermograph tabulating instrument, using the white line as datum; and the reading of this datum that shall correspond to the reading ·000 of the rain curve, when the receiving vessel has just been discharged, is re-determined whenever the adjustment of the recording apparatus is disturbed. For this purpose an average is taken of a number of measurements for all of which the rain is falling very slowly at the time of the syphon's coming into action and for a short time longer. It is necessary to select such occasions, because at times of heavy rainfall the curve has risen sensibly before the light has had time to make a distinct impression on the sensitive paper. The mode of tabulating is (1) to set the scale on the constant reading corresponding to the white line, (2) to move the sliding piece until the index is set upon the white line, and (3) to move the sliding bar till the index is set upon the curve, and then read the scale. By setting the paper carefully, so that a considerable length of the white line is practically parallel to the lateral motion of the frame, the repetition of the first two operations of tabulation is avoided until many hourly ordinates have been read; and then a new setting of the paper is made for another stretch of the white line.

Description of the Tables of Meteorological Results and of the Processes of Reduction, 1890.

30. *Barometric Pressure.*—In Table I is shown, for every day in the year, the mean of 24 hourly tabulations of the barograph, corrected* to agree with Newman's barometer No. 58;—also the mean pressure for each month and each year, and the excess of each monthly mean above the annual mean for the same year; and the principal features of the annual variation are indicated at the foot of the table. The maximum and minimum daily pressures in each month are distinguished by being printed in strong figures.

31. *Temperature of the Air, &c.*—The plan of the following tables is the same as that of Table I, but the subjects of them and the sources from which the numbers are obtained and the mode of obtaining them are as stated below:—

Table II.—Temperature of the air: derived from hourly tabulations of the thermograph dry-bulb.

Table III.—Pressure of vapour: derived from hourly tabulations of the thermograph dry-bulb and wet-bulb, and of the barograph; and calculated in the manner described in paragraph 22.

Table IV.—Additional capacity of the air: derived from hourly differences between the pressure of vapour corresponding to the temperature of the air and the calculated actual pressure of vapour.

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* In the manner described in paragraph 54 of the Introduction of the "Bombay Magnetical and Meteorological Observations for 1871 to 1878."

Table VII.—Velocities of the north and east components of the wind: derived from hourly tabulations from the register of the Robinson-Beckley anemograph.

Table VIII.—Velocity of the wind regardless of direction: derived from hourly tabulations from the register of the Robinson-Beckley anemograph.

Table XI.—Extent of cloudy sky: derived from estimations made at the hours 6, 10, 14, 16, and 22 daily.

32. Tables VI and XII are on the same plan as Table I, except that the entries made in them are aggregates—daily, monthly and yearly—instead of mean values; and they are sufficiently explained by their several headings.

33. *Monthly and annual range of variation of Meteorological Elements.*—Table V shows the extreme limits between which the oscillations of barometric pressure, temperature of the air, pressure of vapour, and additional capacity of the air were confined in each month and in the whole year, and also the ranges of the respective oscillations.

34. The numbers in Table IX are derived from hourly tabulations from the register of the Robinson-Beckley anemograph. The temperatures of the ground given in Table X are derived from the readings of the several thermometers, made five times a day as regards the 1 inch and 9 inches deep thermometers, and once a day as regards the 20 inches, 60 inches and 132 inches deep thermometers. The five-day means of Table XIII are derived from hourly tabulations of the barograph (combined with readings of Newman's barometer No. 58) and thermograph, from the measurements in Newman's rain-gauge, and from hourly tabulations from the register of the Robinson-Beckley anemograph. The rainfall of Table XIV is that received in Newman's gauge. In other respects these tables require no explanation beyond their titles, the headings of the several columns, and the foot-notes.

Notes on instrumental changes and on all irregularities or departures from the routine of observation or reduction, 1890.

35. *Robinson-Beckley Anemograph.*—String of driving weight of clock broke on October 5. External parts painted on December 22. The aggregate of all the interruptions of the instrument in the year 1890 was $1^h\ 2^m$: the loss of record was, however, rarely complete, and values partly or entirely interpolated have been inserted whenever the interruption was not somewhat prolonged. To aid in the making of interpolations, it has been customary, whenever the action of the instrument was voluntarily interrupted for more than one hour, to observe the direction of the wind by estimation, and to record the readings of a small auxiliary velocity measurer put up for the occasion but this has not had to be done in the year 1890. No complete day's records have been omitted in the formation of monthly abstracts.

36. When for any reason the traces furnished by the photographic self-registering instruments are interrupted, and the interruption includes the moments when one or more hourly tabulations should be made, these last are either substituted by the corresponding eye-observations, if the hours should happen to be any of the five regular observation hours, or if special eye-observations were taken for the purpose, or else, if no eye-observations are available, they are interpolated. In the last case, if the interruption lasts for less time than one hour, the interpolation is made on the assumption that the rate of change of the phenomenon from its value at the beginning to its value at the end of the interruption was uniform, providing that the parts of the curve immediately preceding and immediately following the gap were, in appearance, continuations

of the straight line connecting the extremities of the gap. If the last condition is not satisfied, or if the gap, taking account of points inserted by means of eye-observations, is of greater length than one hour, the interpolation is made between the next preceding and the next following hourly entries, first, by allowing for the known *normal* rate of change of the phenomenon between those hours in the same month, and then by assuming that any additional change, shown by the difference between the values of the phenomenon at the two extreme hours, has grown at a uniform rate. Interpolated values are entered in the abstract sheets with enclosing square brackets—inserted eye-observations between parentheses.

37. *Barograph.*—No tabulations were obtained for the following hours for the several reasons stated, but eye-observations were available and were adopted for the hours marked within parentheses.

(1) Owing to stoppage of clock: for 1890 October 30^d (14^h) and (15^h).

(2) Owing to failure of lights: for 1890 March 12^d (14^h).

Occasional, though rare, failure of the bihourly stops to act has caused no loss of record.

The aggregate of all the interruptions of the barograph in the year 1890 was $1^h 16^m$*, and the number of hourly tabulations lost was 3, but for all of these eye-observations were substituted.

38. *Thermograph dry-bulb.*—The aggregate of all the interruptions of the thermograph dry-bulb in the year 1890 was $0^h 24^m$; but no hourly tabulation was lost.

39. *Thermograph wet-bulb.*—The aggregate of all the interruptions of the thermograph wet-bulb in the year 1890 was $9^h 12^m$, made up chiefly of short intervals of time occupied in cleaning and renewing the muslin coverings of the bulbs and the bundles of threads connecting them with the supply of water. No hourly tabulation was lost.

40. *Self-registering Rain-gauge.*—There was no loss of hourly tabulations in the year 1890.

II.—MAGNETICAL INSTRUMENTS, 1890.

Kew Absolute Declinometer and Deflection and Vibration Apparatus.

41. A description of this instrument, with which the observations of absolute declination and of horizontal intensity for the year 1890 have been taken, will be found on pages xxxiii to liii of the Introduction to the "Bombay Magnetical and Meteorological Observations, 1865—70"; the description includes also an account of the situation of the instrument, of the nature and routine of the observations taken with it—with examples of observation and computation forms filled up with the figures of actual observations—and of the formulæ of reduction and the constants involved in them.

42. The entries in columns 1 to 17 and 19 of the Tables of Observations of Absolute Horizontal Force are copied directly from the computation form: column 18 is given to show the degree of accordance existing in the determinations from deflections with the deflecting magnet at the respective distances 0·8 foot and 1·0 foot from the deflected magnet; and the numbers in column 21 are the products of those in column 20 multiplied by the constant number ·46108.

* If not unusually prolonged, the short interruptions caused by the regular changing of photographic papers and by changing of lamps are not included in the above aggregate, nor in the aggregates of interruptions of the thermograph that follow further on.

43. The description, referred to above, of the observation of absolute declination will render clear the meaning of the numbers entered in each column of the Tables of Observations of Absolute Declination: all of these, except the monthly means in columns 12 and 13, are taken directly from the observation form.

KEW DIP CIRCLE.

44. A description of this instrument, and of the mode of using it, is also given in the Introduction to the "Bombay Magnetical and Meteorological Observations, 1865—70", pages lvi to lix, and the following additional or corrective remarks will make it applicable to the observations of 1890:—

(1) The place of observation has been the top room of the Electrometer Tower, the dip circle having been placed on the same pillar on which the Kew unifilar magnetometer is placed in the regular observations of absolute horizontal force and absolute declination. The reading of the azimuth circle adopted for this place has invariably been 63° 31′. An observation for the verification of this reading was made on the 22nd February 1881.

(2) The dip needles used during the year 1890 have been as follows:—
For the regular observations:—
Dover, Charlton No. 1.
" " No. 2.
And for supplementary observations:—
John Dover No. $\frac{1}{61}$.
" " No. $\frac{2}{61}$.

(3) The final cleaning of the axles of the needles has throughout been made with a clean silk cloth.

CHARLES CHAMBERS,
Director.

Colába Observatory, December 1891.

TABLES OF RESULTS

DERIVED

FROM THE CONTINUOUS REGISTRATIONS OF AUTOMATIC METEOROLOGICAL INSTRUMENTS

AND FROM

METEOROLOGICAL OBSERVATIONS,

1890.

TABLES OF RESULTS

DERIVED FROM THE

METEOROLOGICAL OBSERVATIONS MADE DAILY AT 6, 10, 14, 16, AND 22 HOURS,

1890.

FIVE-DAY MEANS,

AND ANNUAL AND LUSTRAL MEANS,

1890.

P 1210—1 R

TABLE I.—Barometric Pressure, 1890.

Height of Barometer above mean Sea-level = 37 feet.

1890. Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
1	29·880	29·992	29·843	29·845	29·779	29·582	29·599	29·720	29·806	29·843	29·819	29·874
2	·904	**30·023**	·868	·806	·722	**·576**	·615	·712	·853	·851	**·793**	**·863**
3	·952	·022	·902	·810	·718	·623	·692	·707	·860	·851	·795	·912
4	·927	29·966	·945	·846	·757	·680	·758	·722	825	·828	·835	·906
5	·906	·947	**·973**	·839	·757	·676	**·773**	·695	·789	·824	·856	·898
6	·928	·984	·923	·839	·714	·668	·731	·643	·753	·847	·815	·899
7	**·963**	·969	·868	·856	·668	·647	·673	**·634**	·737	·865	·819	·919
8	·944	·955	·846	·860	·710	·645	·724	·692	·713	·819	·914	·937
9	·932	·962	·862	**·876**	·772	·638	·720	·707	·675	·793	·965	·934
10	·902	·972	·878	·876	·798	·628	·691	·662	**·645**	·776	·927	·927
11	·884	·947	·830	·789	·817	·613	·698	·659	·676	**·749**	·898	·882
12	883	·934	·823	·730	·806	·606	·692	·744	·698	·772	·910	·912
13	·890	·904	·819	·797	·842	·610	·669	·761	·721	·783	·920	·906
14	·890	·865	·833	·762	**·845**	·600	·677	·755	·752	·773	·944	·917
15	·889	·810	·845	·808	·794	·579	·679	·796	·718	·828	·934	·946
16	·901	**·791**	·834	·798	·757	·585	·673	·794	·747	·902	·939	·958
17	·911	·828	·807	·731	·750	·623	·632	·767	·800	·929	·953	·959
18	·934	·881	·767	·739	·760	·622	·626	·770	·808	·893	·972	·967
19	·904	·880	**·755**	·764	·748	·607	·611	·778	·795	·907	·994	·965
20	·890	·893	·777	·765	·732	·590	·579	·795	·816	·951	·994	·979
21	·915	·883	·796	·730	·740	·623	**·552**	·818	·834	**·960**	·987	·986
22	·936	·861	·767	·728	·737	·633	·587	·812	·836	·933	30·001	·968
23	·926	·848	·772	·733	·775	·611	·587	·807	·841	·903	**·012**	·966
24	·916	·870	·798	·752	·744	·623	·595	·824	·837	·896	29·991	30·018
25	·888	·872	·815	**·725**	·753	·665	·647	·831	·798	·912	·964	**·023**
26	·877	·870	·831	·750	·783	·695	·641	**·835**	·788	·898	·911	29·976
27	**·874**	·882	·852	·789	·776	**·703**	·685	·799	·825	·877	·912	·971
28	·874	·871	·848	·741	·738	·692	·717	·816	·873	·877	·939	·992
29	·902		·879	·748	·718	·680	·725	·833	**·878**	·873	·949	30·012
30	·932		·866	·798	·730	·636	·688	·795	·852	·834	·925	·011
31	·961		·856		**·645**		·695	·759		·823		29·985
Monthly Mean.	29·910	29·911	29·841	29·788	29·754	**29·632**	29·666	29·756	29·785	29·857	29·920	**29·947**
Annual Variation ...	+·096	+·097	+·027	—·026	—·060	—·182	—·148	—·058	—·029	+·043	+·106	+·133

	in.
Annual mean	29·814
The greatest mean daily barometric pressure in the year (that of 2nd February) was	30·023
The least do. do. do. (that of 21st July) was	29·552
Difference =	0·471

TABLE II.—Temperature of the Air, 1890.

1890. Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	°	°	°	°	°	°	°	°	°	°	°	°
1	76·4	76·3	79·0	80·5	85·4	82·4	80·0	**77·1**	78·7	80·8	79·4	76·9
2	75·5	76·3	77·9	80·6	85·7	81·9	80·8	78·8	79·2	81·2	78·0	76·4
3	74·8	76·3	77·9	**79·8**	83·4	83·7	81·2	79·1	79·1	81·1	79·0	76·6
4	74·9	75·1	78·2	80·3	**82·3**	84·0	81·2	79·2	79·6	79·5	79·9	76·5
5	74·1	75·3	78·0	80·0	82·8	83·0	**81·3**	79·5	79·5	**76·0**	79·5	77·2
6	74·2	75·3	**77·3**	80·3	83·7	80·4	80·6	78·4	80·0	78·9	78·6	77·2
7	75·0	**74·7**	78·0	81·4	83·7	81·8	80·9	77·6	79·9	79·8	79·0	77·0
8	75·3	75·0	78·4	82·5	82·5	**84·7**	81·2	79·4	79·4	80·6	78·5	77·8
9	75·5	75·6	79·2	82·4	82·9	82·8	80·1	78·9	80·1	81·5	79·8	**78·7**
10	74·8	77·4	77·9	81·8	82·9	82·3	79·4	78·1	79·8	81·7	80·4	77·9
11	74·6	78·6	77·5	82·4	83·3	82·5	80·0	78·9	77·2	**82·0**	**81·3**	76·6
12	74·8	78·8	78·4	**84·6**	83·4	83·7	79·8	79·1	79·5	81·5	80·4	75·6
13	76·2	78·1	79·0	84·3	83·1	82·0	80·8	78·7	79·5	81·9	80·0	74·0
14	77·2	77·0	78·8	83·1	82·9	80·0	81·3	78·5	79·7	81·6	78·9	73·5
15	76·3	76·2	78·6	82·5	82·9	79·5	79·3	79·3	**76·9**	80·8	78·9	**73·1**
16	76·0	75·7	78·5	81·2	82·6	79·5	78·0	79·2	78·0	80·3	78·4	73·9
17	75·8	77·2	78·9	82·2	82·9	79·4	79·1	78·7	79·0	80·5	78·3	74·5
18	75·4	76·1	80·8	82·0	83·1	77·8	79·9	78·7	79·8	79·2	78·5	73·4
19	75·8	76·6	**81·8**	82·3	83·6	**77·5**	78·4	78·8	80·5	78·2	78·0	74·2
20	76·0	77·6	81·6	83·3	83·6	79·2	79·8	77·6	79·7	78·5	76·8	75·9
21	74·3	78·6	80·9	84·2	84·1	79·8	78·4	78·7	79·5	78·5	**75·3**	76·3
22	73·1	**79·7**	80·3	83·9	83·9	81·0	78·7	78·2	79·6	79·1	76·5	76·1
23	74·3	79·5	79·9	84·2	84·9	81·4	78·9	78·3	80·0	79·3	77·9	76·1
24	73·7	78·4	81·1	83·4	84·6	81·6	78·6	78·7	79·2	79·8	78·3	77·5
25	**72·1**	78·3	80·6	83·5	85·0	81·5	79·8	80·0	80·3	80·8	77·9	76·9
26	73·9	78·3	79·3	81·9	85·7	82·4	80·2	**80·2**	80·4	80·5	77·9	76·2
27	73·4	79·0	79·9	82·2	**86·1**	82·1	79·9	78·7	**80·6**	81·3	77·8	76·0
28	74·0	79·4	80·3	82·8	86·1	82·4	78·6	79·4	80·6	80·8	77·9	77·1
29	**77·4**		79·2	83·2	86·0	81·5	**77·7**	79·1	80·2	79·6	77·3	76·9
30	77·2		80·2	83·8	84·3	79·7	79·8	77·5	79·8	80·5	76·8	76·3
31	76·5		80·4		84·0		78·7	78·0		78·6		75·6
Monthly Mean.	**75·1**	77·2	79·3	82·4	**83·9**	81·4	79·8	78·7	79·5	80·1	78·5	76·1
Annual Variation ...	—4·2	—2·1	0·0	+3·1	+4·6	+2·1	+0·5	—0·6	+0·2	+0·8	—0·8	—3·2

	°
Annual mean	79·3
The greatest mean daily temperature of the air in the year (that of 27th May) was	86·1
The least do. do. do. (that of 25th January) was	72·1
Difference =	14·0

TABLE III.—Pressure of Vapour, 1890.

1890. Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
1	0·626	0·604	0·703	0·750	0·903	0·893	0·868	0·835	0·809	0·884	0·671	0·681
2	·631	·582	·766	**·732**	·851	·889	**·896**	·850	·820	·903	·691	·635
3	·598	·574	·738	·794	·857	·914	·886	·852	·802	·877	·745	·661
4	·575	**·534**	·716	·827	·839	·932	·878	·857	·780	·813	·839	·671
5	·596	·543	·693	·810	·887	·933	·878	·865	·782	·783	·845	·753
6	·573	·564	·677	·786	·899	·914	·867	**·871**	·774	·826	·762	·743
7	·598	·618	·679	·812	·855	·935	·879	·848	·796	·856	·831	·747
8	·629	·610	·710	·867	**·764**	·930	·877	·850	·821	·852	·859	·747
9	·610	·581	·703	·885	·771	·916	·874	·843	·872	·853	·868	**·773**
10	·602	·682	·677	·889	·790	·921	·860	·840	**·908**	·885	**·880**	·621
11	·589	·640	**·662**	·834	·820	·928	·864	·845	·856	·909	·799	·587
12	·608	·622	·681	·774	·834	·936	·858	·820	·834	·919	·727	·550
13	·591	·570	·704	·802	·834	**·947**	·885	·832	·816	**·947**	·717	**·682**
14	·584	·636	·725	·832	·842	·928	·881	·820	·805	·923	·753	·503
15	·611	·702	·685	·829	·862	·888	·857	·804	·838	·884	·736	·552
16	**·649**	·707	·738	·829	·837	·889	·857	·819	·836	·868	·671	·611
17	·639	·730	·756	·854	·837	·890	·848	·809	·855	·807	·705	·638
18	·635	·682	·729	·829	·851	·873	·860	·802	·858	·816	·728	·504
19	·600	·661	·759	·821	·884	**·859**	·854	·813	·844	·761	·680	·581
20	·616	·635	**·782**	·882	·889	·878	·888	·829	·807	·749	**·514**	·658
21	·601	·626	·764	**·934**	·854	·909	·888	·833	·776	·791	·557	·635
22	·588	·685	·766	·927	·890	·920	·868	·823	**·766**	·825	·639	·620
23	·646	·741	·754	·834	·893	·904	·878	·812	·816	·804	·654	·651
24	·541	**·748**	·699	·848	·871	·911	·868	·812	·781	·752	·646	·701
25	·520	·700	·708	·826	·888	·910	·881	·814	·810	·729	·658	·697
26	·501	·676	·763	·792	·901	·926	·881	·804	·811	·762	·671	·673
27	**·478**	·655	·739	·817	**·952**	·896	·865	·780	·836	·774	·680	·665
28	·500	·626	·705	·838	·927	·901	·865	·774	·847	·753	·673	·677
29	·545		·700	·902	·923	·870	**·839**	**·767**	·838	·707	·655	·669
30	·569		·705	·920	·926	·864	·856	·786	·844	**·607**	·653	·684
31	·596		·761		·902		·855	·823		·634		·628
Monthly Mean...	0·589	0·641	0·721	0·836	0·866	**0·907**	0·870	0·824	0·821	0·815	0·717	0·644
Annual Variation ...	—·182	—·130	—·050	+·065	+·095	+·136	+·099	+·053	+·050	+·044	—·054	—·127

	in.
Annual mean	0·771
The greatest mean daily pressure of vapour in the year (that of 27th May) was	0·952
The least do. do. do. (that of 27th January) was ...	0·478
Difference =	0·474

TABLE IV.—Additional Capacity of the Air, 1890.

1890. Date.	MONTH. January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
1	0·288	0·307	0·291	0·295	0·318	0·219	0·156	**0·095**	0·172	0·169	0·338	0·249
2	·258	·329	**·190**	·317	**·383**	·203	·156	·134	·182	·163	·277	·279
3	·270	·338	·220	·226	·288	·241	·178	·143	·193	·187	·248	·257
4	·299	·339	·251	·210	·269	·237	·186	·141	·232	·194	·185	·246
5	·252	·339	·266	·217	**·239**	·198	**·191**	·142	·228	**·116**	·165	**·183**
6	·282	·316	·265	·251	·259	·124	·178	·101	**·251**	·165	·218	·193
7	·277	·245	·281	·260	·302	·153	·176	·098	·228	·164	·162	·213
8	·254	·263	·264	·247	·349	**·262**	·188	·155	·184	·197	**·114**	·205
9	·282	·312	·297	·225	·355	·205	·154	·147	·156	·225	·152	·212
10	·265	·267	·280	**·198**	·340	·184	·146	·123	·112	·199	·161	·336
11	·273	·348	·282	·276	·324	·183	·161	·144	**·077**	·186	·274	·334
12	·263	·372	·293	**·423**	·311	·219	·158	·174	·173	·157	·315	·341
13	·323	**·398**	·288	·379	·299	·147	·167	·150	·192	·148	·314	**·365**
14	·361	·295	·264	·305	·286	·094	·187	·156	·208	·158	·240	·329
15	·302	·206	·296	·283	·264	·120	·144	·199	·085	·170	·254	·268
16	·256	**·186**	·238	·240	·280	·120	·103	·180	·125	·169	·304	·231
17	·259	·205	·233	·250	·292	·114	·145	·174	·137	·235	·267	·219
18	·251	·223	·329	·268	·285	**·079**	·161	·179	·159	·183	·253	·325
19	·298	·261	·331	·288	·269	·085	·116	·172	·199	·206	·284	·269
20	·286	·318	·299	·262	·264	·121	·129	·118	·207	·229	**·414**	·241
21	·252	·357	·294	·242	·319	·109	**·083**	·148	·230	·187	·326	·278
22	·232	·339	·271	·239	·273	·138	·112	·142	·244	·171	·279	·287
23	**·204**	·270	·271	·340	·309	·168	·111	·159	·210	·199	·309	·256
24	·291	·228	**·367**	·296	·320	·167	·110	·171	·217	·272	·326	·248
25	·274	·272	·341	·323	·319	·166	·137	·211	·225	·324	·304	·229
26	·349	·298	·240	·300	·332	·182	·151	·227	·227	·282	·290	·233
27	·350	·339	·286	·284	·299	·201	·157	·202	·210	·301	·279	·236
28	·349	·384	·334	·286	·322	·209	·113	**·231**	·199	·300	·290	·261
29	**·408**		·299	·239	·322	·206	·111	·229	·195	·309	·288	·260
30	·374		·333	·240	·251	·150	·161	·159	·175	**·443**	·271	·224
31	·320		·280		·265		·127	·138		·352		·260
Monthly Mean.	0·290	0·298	0·283	0·274	**0·300**	0·167	**0·147**	0·159	0·188	0·218	0·263	0·260
Annual Variation.	+·053	+·061	+·046	+·037	+·063	—·070	—·090	—·078	—·049	—·019	+·026	+·023

	in.
Annual mean	0·237
The greatest mean daily additional capacity of the air in the year (that of 30th October) was	0·443
The least do. do. do. (that of 11th September) was	0·077
Difference =	0·366

Maxima and Minima of different Meteorological Elements, 1890.

TABLE V.—*In which are collected the individual observations in each month of the year, which showed the greatest and the least values of the following elements, viz., Height of Barometer corrected for Temperature; Temperature of Air; Pressure of Vapour; and Additional Capacity of Air.*

1890.	HEIGHT OF BAROMETER.			TEMPERATURE OF AIR.			PRESSURE OF VAPOUR.			ADDITIONAL CAPACITY.		
Month	Greatest.	Least.	Range.	Greatest.	Least.	Range.	Greatest.	Least.	Range.	Greatest.	Least.	Range.
	in.	in.	in.	°	°	°	in.	in.	in.	in.	in.	in.
January ...	30·039	29·813	0·226	87·8	67·1	20·7	0·777	0·337	0·440	0·927	0·090	0·837
February	·090	·729	·361	88·2	68·9	19·3	·854	·400	·454	·803	·077	·726
March ...	·052	·684	·368	87·0	72·9	14·1	·834	·543	·291	·664	·100	·564
April ...	29·946	·643	·303	90·6	75·6	15·0	·983	·598	·385	·728	·091	·637
May ...	·912	·574	·338	91·1	78·8	12·3	·980	·700	·280	·601	·113	·488
June ...	·747	·505	·242	87·8	75·3	12·5	1·008	·788	·220	·407	·055	·352
July ...	·809	·513	·296	84·1	75·3	8·8	0·944	·787	·157	·276	·048	·228
August ...	·891	·582	·309	83·9	74·8	9·1	·912	·725	·187	·334	·045	·289
September.	·941	·585	·356	84·3	73·5	10·8	·974	·723	·251	·370	·049	·321
October ...	30·034	·687	·347	89·6	72·4	17·2	1·009	·448	·561	·944	·062	·882
November.	·086	·749	·337	88·8	70·2	18·6	0·933	·394	·539	·779	·067	·712
December.	·094	·803	·291	85·8	66·9	18·9	·841	·360	·481	·622	·084	·538
Year ...	30·094	29·505	0·589	91·1	66·9	24·2	1·009	0·337	0·672	0·944	0·045	0·899

Rainfall, 1890.

TABLE VI.—*Total Fall of Rain (in inches) as measured by F. Chambers's Self-registering Gauge, the funnel of which is 28 feet above the ground.*

1890. Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
					in.	in.	in.	in.	in.	in.	in.	in.
1						0·22	0·76	**2·47**	0·01			
2						0·34	0·31	0·58				
3						0·04	0·25	0·08				
4						0·39	0·08	0·12		**0·50**	0·02	
5							**0·03**	0·01		0·02	**1·05**	0·11
6						1·62	0·05	0·37			0·01	
7						0·45	0·34	1·59		0·02		
8							0·05	0·18	0·06		0·02	
9						0·09	0·64	0·15	0·31			
10						0·08	1·30	0·47	0·31			
11						0·03	0·41	0·30	**2·32**			
12							1·39	0·14				
13						0·61	0·33	0·10	0·03			
14						1·32	0·07	0·38	0·10			
15						2·06	1·17	0·37	2·17			
16						0·58	2·35	0·07	0·25			
17						0·63	0·25	0·15	0·64			
18						4·28	0·17	0·07	0·02			
19						**4·39**	0·80	0·09				
20						1·56	0·58	0·56	0·01			
21						0·97	**3·25**	0·14				
22						0·44	0·70	0·17				
23						0·46	1·08	0·12				
24						0·30	0·73	0·10	0·01			
25						0·42	0·34	0·02	0·02			
26						0·02	0·07	0·07	0·03			
27						0·04	0·14	0·58				
28						0·03	0·75		0·02			
29						0·28	1·68					
30					0·04	1·73	0·46	0·55				
31							0·48	0·54				
Monthly Total.					0·04	**23·38**	21·01	10·54	6·31	0·54	1·10	0·11
Number of rainy days.					1	27	**31**	29	16	3	4	1

Total fall of rain in the year ... ... 63·03 inches.
Total number of rainy days in the year 112
The greatest daily fall of rain in the year (that of 19th June) was ... ... 4·39 inches.

No rain fell in the months of January, February, March and April, nor on any of the days left blank in the above table.

Mean Daily Velocities of the North and East Components of the Wind, 1890.

TABLE VII.—*Showing the Mean Velocities of the North or South and East or West Components of the Winds which blew on each day of the year 1890.*

In Miles per Hour.

1890.	MONTH.																							
Date.	January.		February.		March.		April.		May.		June.		July.		August.		September.		October.		November.		December.	
	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.
1 ...	6·2 N	0·2 E	7·6 N	2·5 W	10·3 N	6·9 W	9·4 N	6·1 W	3·9 N	9·6 W	14·4 S	2·0 W	5·0 S	20·1 W	2·6 S	21·0 W	6·7 S	3·8 W	7·8 N	6·2 W	6·1 N	2·8 E	5·2 N	0·7 W
2 ...	4·2 N	1·6 E	6·1 N	1·0 W	5·3 N	6·1 W	8·9 N	6·4 W	12·1 N	10·7 W	19·6 S	10·3 E	3·1 S	19·0 W	2·8 S	21·2 W	4·4 S	4·9 W	7·2 N	6·0 W	3·8 N	0·7 E	3·6 N	1·0 E
3 ...	7·3 N	0·0	7·0 N	2·2 W	0·1 S	5·5 W	0·9 N	4·6 W	9·2 N	9·1 W	23·8 S	4·7 E	12·7 S	16·5 W	7·1 S	18·0 W	0·9 N	8·0 W	8·0 N	8·4 W	4·2 N	0·7 W	3·6 N	0·9 E
4 ...	6·8 N	1·0 E	8·1 N	4·4 W	1·2 N	4·5 W	3·7 S	4·8 W	11·8 N	8·4 W	21·9 S	0·2 W	12·2 S	13·1 W	1·1 S	18·3 W	1·9 N	8·2 W	7·6 N	5·7 W	1·9 S	1·5 W	8·0 N	1·4 W
5 ...	4·7 N	0·7 W	10·0 N	3·8 W	6·7 N	7·6 W	3·2 N	6·5 W	10·5 N	8·9 W	12·5 S	1·8 W	7·0 S	17·1 W	0·4 N	17·3 W	0·4 N	7·5 W	0·8 S	4·8 W	1·1 S	3·9 E	1·7 N	1·2 W
6 ...	4·3 N	1·8 E	12·9 N	3·4 W	5·2 N	3·5 W	5·3 N	8·0 W	4·5 N	7·8 W	3·7 S	9·3 W	5·6 S	18·6 W	4·0 N	18.3 W	2·7 N	9·1 W	0·8 S	2·2 W	2·9 N	4·2 E	0·9 N	1·5 W
7 ...	1·3 N	1·7 E	12·5 N	5·5 W	1·6 N	5·6 W	8·8 N	4·3 W	0·6 N	7·8 W	7·5 S	5·3 W	4·6 S	20·9 W	0·3 N	22·8 W	0·1 N	4·6 W	1·7 N	2·1 E	0·4 S	0·4 W	3·4 N	1·4 W
8 ...	5·6 N	1·3 E	10·3 N	4·0 W	2·9 S	5·2 W	2·3 S	5·5 W	2·6 N	8·0 W	0·7 S	11·4 W	6·6 S	19·9 W	1·2 S	19·2 W	5·3 N	3·0 W	3·7 N	2·6 W	2·0 S	4·7 E	7·8 N	1·1 W
9 ...	5·2 N	2·5 E	7·1 N	1·3 W	2·8 S	7·4 W	1·1 N	2·8 W	0·9 S	8·0 W	9·1 S	6·7 W	6·1 S	21·4 W	5·9 S	16·6 W	7·3 N	5·1 W	3·3 N	1·1 E	3·6 N	4·8 W	7·2 N	0·7 W
10 ...	4·0 N	0·5 E	4·5 N	1·1 W	3·6 N	5·3 W	3·2 N	5·6 W	1·9 S	7·6 W	6·0 S	2·7 W	3·2 S	23·2 W	5·9 S	21·3 W	4·0 N	5·9 W	3·3 N	1·5 W	6·3 N	2·2 W	10·4 N	2·1 W
11 ...	4·5 N	1·8 E	8·8 N	2·6 W	5·0 N	5·5 W	5·8 N	7·3 W	2·1 S	7·6 W	8·8 S	0·2 E	6·9 S	20·5 W	5·0 S	23·7 W	1·6 N	11·4 W	5·5 N	2·4 W	6·9 N	0·4 E	11·0 N	2·0 W
12 ...	5·5 N	0·1 E	4·2 N	0·4 W	6·4 N	3·7 W	11·7 N	5·8 W	0·0	7·9 W	9·5 S	0·5 E	2·1 S	22·2 W	7·2 S	19·1 W	2·7 S	13·3 W	4·8 N	3·6 W	4·5 N	2·6 E	9·8 N	2·6 W
13 ...	6·4 N	1·7 E	8·1 N	1·2 W	10·1 N	5·8 W	5·7 N	6·5 W	3·2 N	8·3 W	17·1 S	1·7 E	2·1 S	21·3 W	2·9 S	17·8 W	1·0 S	12·2 W	2·2 N	4·5 W	3·2 N	4·7 E	11·1 N	2·0 W
14 ...	5·0 N	3·4 E	6·3 N	3·4 W	9·8 N	6·7 W	2·4 N	7·7 W	7·7 N	8·6 W	11·4 S	5·4 W	2·6 S	19·7 W	2·6 S	19·8 W	3·1 S	14·2 W	2·2 N	3·8 W	5·2 N	1·7 E	8·8 N	1·0 W
15 ...	4·5 N	1·0 E	4·7 N	3·2 W	6·4 N	9·1 W	0·6 S	6·9 W	7·2 N	9·4 W	21·0 S	1·6 W	4·4 S	20·0 W	0·3 S	18·5 W	1·6 S	7·4 W	2·5 N	3·3 W	3·1 N	1·4 E	6·5 N	0·5 W
16 ...	1·5 N	0·8 E	3·4 N	3·2 W	7·1 N	6·4 W	8·2 N	5·6 W	3·3 N	6·6 W	22·2 S	1·2 W	3·5 S	20·8 W	0·0	18·2 W	1·5 S	3·4 W	7·5 N	2·6 W	6·1 N	0·3 E	6·5 N	0·6 E
17 ...	2·0 N	2·0 S	4·2 N	3·0 W	6·6 N	7·5 W	10·8 N	9·6 W	3·6 N	7·4 W	13·7 S	3·5 W	1·5 S	21·5 W	2·2 S	14·6 W	0·5 S	3·1 W	9·2 N	1·0 W	4·7 N	0·4 E	9·6 N	0·5 E
18 ...	4·9 N	0·2 W	7·4 N	3·3 W	11·6 N	5·2 W	8·8 N	7·1 W	4·2 N	7·6 W	6·8 S	18·2 W	4·3 S	22·5 W	4·9 S	15·0 W	2·9 N	6·3 W	6·8 N	5·1 W	2·0 N	0·4 E	11·7 N	2·1 W
19 ...	5·6 N	0·1 W	8·8 N	3·7 W	13·1 N	6·4 W	9·4 N	5·4 W	5·9 N	9·4 W	8·8 S	20·2 W	4·6 S	20·5 W	4·8 S	16·2 W	4·0 N	14·3 W	3·9 N	2·8 W	6·4 N	0·8 W	6·7 N	0·4 W
20 ...	8·1 N	1·5 W	11·4 N	3·1 W	11·2 N	6·7 W	2·2 N	4·8 W	0·4 N	7·2 W	11·7 S	18·4 W	0·6 N	19·2 W	0·1 S	13·0 W	2·1 N	14·4 W	5·4 N	0·9 W	8·2 N	0·7 W	5·2 N	0·3 W
21 ...	9·7 N	3·4 W	11·5 N	3·3 W	10·7 N	7·2 W	7·7 S	5·5 W	1·8 S	6·9 W	16·3 S.	10·8 W	1·0 S	18·8 W	0·4 S	11·8 W	3·6 N	12·8 W	11·1 N	1·9 W	2·7 N	1·4 E	7·4 N	1·1 E
22 ...	10·4 N	3·8 W	3·8 N	0·5 W	13·9 N	9·5 W	11·6 S	5·4 W	1·6 N	7·7 W	7·0 S	12·7 W	4·6 S	15·5 W	2·9 S	10·9 W	5·1 N	7·4 W	7·4 N	4·2 W	4·0 N	0·3 E	8·6 N	0·6 W
23 ...	9·1 N	4·6 W	0·3 N	1·3 W	13·2 N	9·7 W	3·5 N	8·3 W	5·5 S	6·1 W	7·8 S	16·3 W	5·0 S	15·4 W	1·4 S	13·3 W	6·0 N	5·8 W	8·2 N	3·1 W	4·1 N	1·3 E	4·9 N	0·2 W
24 ...	10·2 N	3·1 W	1·7 N	3·4 W	14·5 N	8·1 W	1·3 N	4·1 W	4·2 S	6·6 W	8·0 S	16·0 W	6·2 S	20·8 W	0·2 S	9·7 W	4·6 N	10·2 W	6·1 N	1·0 E	1·5 N	1·2 E	3·1 N	2·1 E
25 ...	8·9 N	1·2 W	6·6 N	3·7 W	12·5 N	8·9 W	1·3 N	7·6 W	5·4 S	8·9 W	12·2 S	13·2 W	7·7 S	19·3 W	3·2 N	10·4 W	0·1 N	11·1 W	7·1 N	0·8 W	2·7 N	0·9 E	6·5 N	0·5 E
26 ...	7·5 N	1·6 E	7·1 N	3·3 W	12·9 N	9·7 W	4·0 N	7·1 W	6·7 S	8·8 W	10·8 S	11·2 W	7·3 S	18·5 W	3·7 N	8·5 W	0·2 S	12·7 W	5·2 N	0·8 W	3·1 N	2·0 E	10·4 N	2·1 W
27 ...	8·6 N	1·3 W	10·5 N	4·5 W	10·9 N	8·7 W	6·8 N	7·4 W	5·1 S	8·3 W	8·5 S	10·7 W	8·5 S	13·1 W	1·6 N	3·9 W	0·8 N	9·2 W	5·5 N	0·4 W	2·7 N	1·9 E	6·6 N	1·3 W
28 ...	6·8 N	3·0 E	10·6 N	4·9 W	11·9 N	9·4 W	9·5 N	10·0 W	2·4 S	10·2 W	5·8 S	12·2 W	6·9 S	15·9 W	2·1 S	7·5 W	4·8 N	4·9 W	6·0 N	0·0	2·3 N	2·1 E	5·0 N	3·1 E
29 ...	5·2 N	6·7 E			9·6 N	8·8 W	5·7 N	7·9 W	2·7 S	7·6 W	6·2 S	17·0 W	6·6 S	18·3 W	3·2 S	11·0 W	8·4 N	3·6 W	6·9 N	0·5 W	3·9 N	1·0 E	3·8 N	1·4 E
30 ...	6·1 N	2·3 E			11·3 N	7·8 W	1·7 N	8·9 W	5·0 S	5·4 W	6·1 S	23·1 W	3·0 S	18·2 W	4·2 S	12·2 W	8·6 N	5·2 W	9·0 N	3·7 E	3·6 N	0·7 E	7·0 N	0·8 E
31 ...	7·4 N	1·5 E			13·4 N	8·3 W			16·7 S	1·6 W			5·0 S	19·0 W	7·1 S	7·3 W			7·3 N	0·5 W			6·4 N	0·3 W
Monthly Mean ...	6·1 N	0·5 E	7·3 N	2·9 W	8·1 N	7·0 W	3·8 N	6·5 W	1·0 N	7·9 W	11·3 S	7·8 W	5·1 S	19·1 W	2·1 S	15·4 W	1·8 N	8·1 W	5·5 N	2·3 W	3·4 N	1·1 E	6·7 N	0·4 W
Annual Variation ...	4·0 N	6·8 E	5·2 N	3·4 E	6·0 N	0·7 W	1·7 N	0·2 W	1·1 S	1·6 W	13·4 S	1·5 W	7·2 S	12·8 W	4·2 S	9·1 W	0·3 S	1.8 W	3·4 N	4·0 E	1·3 N	7·4 E	4·6 N	5·9 E

The Velocities of the Mean Components for the year are 2·1 N. and 6·3 W.

Velocity of Wind, 1890.

TABLE VIII.—*Mean Velocity of the Wind, in miles per hour, without regard to the direction from which it blew, for each Day of Bombay Civil Time: also the Mean Monthly Velocity, and its Variation from the Mean of the year.*

1890. Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.
1	8·9	10·0	13·3	13·3	12·4	16·8	21·5	21·5	8·8	10·7	**11·0**	8·7
2	8·5	8·0	9·7	12·6	17·2	24·8	19·6	21·7	9·6	10·7	7·7	6·7
3	9·6	9·0	8·4	8·2	14·6	**26·4**	21·3	19·5	8·5	11·7	7·4	9·4
4	9·9	10·1	**7·5**	10·7	15·1	23·7	18·2	18·7	8·6	11·0	5·4	11·2
5	8·4	11·7	11·0	9·1	15·0	14·5	18·6	17·4	7·6	7·8	9·1	**5·3**
6	9·2	14·7	9·1	10·4	9·8	11·3	19·7	19·0	9·6	7·3	9·9	6·7
7	7·3	**14·8**	8·2	11·0	8·5	12·9	22·0	22·9	6·8	8·0	**4·8**	7·5
8	8·8	12·3	8·8	12·3	9·2	11·5	21·2	19·4	7·4	6·9	8·2	9·7
9	8·5	9·4	8·3	**6·2**	8·5	13·3	22·7	17·7	11·4	9·9	7·2	9·7
10	8·2	7·0	9·0	9·5	8·2	**8·3**	**24·2**	22·5	9·1	8·4	7·9	11·5
11	9·0	11·1	11·1	12·2	8·0	10·2	21·8	**24·7**	13·4	8·0	10·0	12·4
12	8·6	7·9	10·4	14·2	8·0	12·3	22·9	20·6	13·9	8·1	8·4	11·0
13	9·2	10·5	12·7	11·2	9·1	18·2	21·8	18·5	12·4	6·7	10·0	12·0
14	10·4	9·2	13·5	9·7	12·6	17·9	20·3	20·3	14·8	**5·3**	9·4	10·3
15	10·3	8·5	11·8	8·5	12·7	22·2	21·0	18·5	11·0	6·5	6·9	8·8
16	**6·2**	7·3	11·6	10·9	9·0	24·1	21·5	18·2	**5·2**	8·7	8·8	9·9
17	7·0	9·7	12·6	**16·0**	9·7	16·2	21·9	15·1	5·7	10·5	8·2	12·3
18	7·9	9·8	14·8	12·8	9·8	20·7	23·3	16·0	8·8	8·8	6·2	**12·5**
19	7·7	11·3	15·7	13·0	12·9	23·1	21·4	17·3	**15·1**	7·4	9·1	9·0
20	9·7	13·1	13·7	7·7	8·2	22·2	19·3	13·8	14·8	10·6	10·1	7·4
21	11·0	13·7	14·2	10·3	**7·8**	20·3	19·4	12·0	13·5	**13·5**	7·1	10·4
22	11·6	6·7	**17·6**	15·2	8·7	15·0	16·4	11·7	9·2	9·2	7·9	10·6
23	11·6	6·7	17·2	10·9	10·5	18·3	16·4	13·8	9·7	10·2	8·5	7·7
24	11·3	**6·2**	17·4	7·6	8·6	18·1	22·1	9·9	11·3	8·9	8·2	7·6
25	11·4	9·5	16·4	10·2	11·0	18·5	20·8	11·1	11·2	8·7	7·4	9·7
26	10·1	10·8	17·5	9·2	11·6	15·7	20·0	9·7	12·7	7·4	7·2	11·8
27	11·0	12·6	15·0	12·3	10·2	14·4	**16·0**	**6·5**	9·5	7·5	7·0	8·5
28	11·5	12·9	16·7	15·0	10·7	13·7	17·4	8·3	9·2	8·1	7·8	8·2
29	12·7		14·3	10·9	8·5	18·4	20·0	11·7	10·5	9·3	7·4	6·4
30	11·0		15·5	11·0	9·0	24·3	18·7	14·0	11·8	12·6	6·7	10·2
31	**12·8**		17·0		**17·9**		20·0	11·3		9·7		8·5
Monthly Mean.	9·7	10·2	12·9	11·1	10·7	17·6	**20·4**	16·2	10·4	9·0	**8·0**	9·4
Annual Variation ...	−2·4	−1·9	+0·8	−1·0	−1·4	+5·5	+8·3	+4·1	−1·7	−3·1	−4·1	−2·7

	Miles.
The Mean Velocity for June to August	18·1
The Mean Velocity for September to May	10·2
The Mean Velocity for the year	12·1
The greatest monthly mean (that of July)	20·4
The least monthly mean (that of November)	8·0
Difference =	12·4
The greatest mean daily Velocity of Wind in the year (that of 3rd June) was	26·4
The least do. do. do. (that of 7th November) was ...	4·8
Difference =	21·6

Aggregate and Mean Velocities and Relative Frequency of Different Winds, 1890.

TABLE IX.—*Showing, for the year 1890, the sums of the Velocities, and the Mean Velocities, in miles per hour, of the Winds which blew in each Month, from each of the sixteen Principal Directions; and also the number of hourly Observations which those sums comprise; the latter numbers indicating the Relative frequency of the same Wind (as to direction) in the several Months, and of different Winds during the same Month.*

1890.	N.			N.N.E.			N.E.			E.N.E.			E.			E.S.E.			S.E.			S.S.E.		
Month.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.
	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.
January ...	568	81	7·0	428	62	6·9	448	63	7·1	1,678	167	10·0	466	64	7·3	25	3	8·3	0	0	0·0	4	1	4·0
February ...	793	95	8·3	259	36	7·2	319	55	5·8	507	74	6·9	109	19	5·7	49	7	7·0	0	0	0·0	3	1	3·0
March ...	397	52	7·6	416	58	7·2	87	12	7·2	173	23	7·5	188	30	6·3	15	3	5·0	12	2	6·0	0	0	0·0
April ...	177	29	6·1	232	40	5·8	82	12	6·8	81	14	5·8	39	6	6·5	24	6	4·0	50	8	6·2	69	8	8·6
May ...	76	15	5·0	142	25	5·7	21	4	5·2	9	2	4·5	0	0	0·0	5	1	5·0	17	2	8·5	126	8	15·7
June... ...	0	0	0·0	10	1	10·0	0	0	0·0	38	5	7·6	43	4	10·7	91	8	11·4	408	27	15·1	1,602	81	19·8
July ...	0	0	0·0	0	0	0·0	0	0	0·0	0	0	0·0	0	0	0·0	0	0	0·0	0	0	0·0	0	0	0·0
August ...	0	0	0·0	2	1	2·0	4	1	4·0	0	0	0·0	15	2	7·5	6	1	6·0	0	0	0·0	10	1	10·0
September ...	51	11	4·6	67	12	5·6	67	12	5·6	101	21	4·8	12	4	3·0	11	3	3·7	48	9	5·3	16	5	3·2
October ...	404	63	6·4	351	61	5·8	466	70	6·7	537	69	7·8	148	24	6·2	72	9	8·0	103	18	5·7	30	5	6·0
November ...	280	48	5·8	289	48	6·0	380	57	6·7	1,477	179	8·3	479	65	7·4	246	34	7·2	52	7	7·4	88	13	6·8
December ...	910	117	7·8	554	85	6·5	346	54	6·4	1,221	154	7·9	145	21	6·9	59	8	7·4	7	1	7·0	0	0	0·0
Year ...	3,656	511	7·2	2,750	429	6·4	2,220	340	6·5	5,822	708	8·2	1,644	239	6·9	603	83	7·3	697	74	9·4	1,948	123	15·8

1890.	S.			S.S.W.			S.W.			W.S.W.			W.			W.N.W.			N.W.			N.N.W.			No. of Observations.		No. of hours.
Month.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Calm	Variable.	Record lost.
	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.			
January ...	4	1	4·0	0	0	0·0	6	1	6·0	13	2	6·5	137	17	8·1	526	50	10·5	1,178	97	12·1	1,703	135	12·6	0	0	0
February ...	3	1	3·0	0	0	0·0	5	1	5·0	43	6	7·2	109	14	7·8	596	53	11·2	2,022	156	13·0	2,018	154	13·1	0	0	0
March ...	30	4	7·5	21	3	7·0	59	8	7·4	272	28	9·7	242	26	9·3	1,510	118	12·8	4,526	264	17·1	1,660	113	14·7	0	0	0
April ...	335	30	11·2	437	41	10·7	286	35	8·2	321	37	8·7	398	51	7·8	2,091	151	13·8	2,197	163	13·5	1,153	89	13·0	0	0	0
May ...	171	10	17·1	474	38	12·5	447	51	8·8	1,525	157	9·7	1,237	140	8·8	1,810	138	13·1	1,372	104	13·2	564	48	11·7	1	0	0
June ...	1,857	84	22·1	1,745	93	18·8	2,150	140	15·4	3,564	206	17·3	1,142	69	16·6	8	2	4·0	0	0	0·0	0	0	0·0	0	0	0
July ...	0	0	0·0	86	4	21·5	903	51	17·7	8,411	421	20·0	5,465	254	21·5	296	14	21·1	0	0	0·0	0	0	0·0	0	0	0
August ...	0	0	0·0	131	9	14·6	259	24	10·8	4,336	255	17·0	6,334	370	17·1	887	68	13·0	96	11	8·7	5	1	5·0	0	0	0
September ...	236	26	9·1	104	10	10·4	50	8	6·2	676	56	12·1	2,704	250	10·8	1,911	166	11·5	1,121	95	11·8	274	31	8·8	0	1	0
October ...	31	7	4·4	29	4	7·2	38	11	3·5	27	5	5·4	186	21	8·9	698	63	11·1	2,269	207	11·0	1,287	107	12·0	0	0	0
November ...	33	5	6·6	7	2	3·5	15	2	7·5	89	17	5·2	397	46	8·6	482	54	8·9	737	71	10·4	731	72	10·2	0	0	0
December ...	0	0	0·0	0	0	0·0	5	1	5·0	0	0	0·0	88	12	7·3	406	46	8·8	1,226	112	10·9	2,037	133	15·3	0	0	0
Year ...	2,700	168	16·1	3,034	204	14·9	4,223	333	12·7	19,277	1,190	16·2	18,439	1,270	14·5	11,221	923	12·2	16,744	1,280	13·1	11,432	883	12·9	1	1	0

Temperature of the Ground, 1890.

TABLE X.—*Showing, for each Month, the Mean Temperature of the Ground, and its Annual Variation, at the respective depths of 1, 9, 20, 60 and 132 inches below the surface.*

DEPTH.	1 INCH.		9 INCHES.		20 INCHES.		60 INCHES.		132 INCHES.	
Month.	Mean Temperature.	Excess over the yearly Mean.	Mean Temperature.	Excess over the yearly Mean.	Mean Temperature.	Excess over the yearly Mean.	Mean Temperature.	Excess over the yearly Mean.	Mean Temperature.	Excess over the yearly Mean.
	°	°	°	°	°	°	°	°	°	°
January ...	77·7	—3·7	77·7	—3·7	80·3	—3·0	82·4	—1·6	82·8	—0·6
February ...	79·6	—1·8	78·9	—2·5	80·7	—2·6	82·3	—1·7	82·4	—1·0
March	81·5	+0·1	81·0	—0·4	82·3	—1·0	82·7	—1·3	82·4	—1·0
April	84·4	+3·0	83·5	+2·1	84·3	+1·0	83·9	—0·1	82·8	—0·6
May	86·0	+4·6	85·2	+3·8	86·1	+2·8	85·3	+1·3	83·5	+0·1
June	83·2	+1·8	83·9	+2·5	86·2	+2·9	86·3	+2·3	84·2	+0·8
July	81·5	+0·1	82·3	+0·9	84·9	+1·6	85·9	+1·9	84·6	+1·2
August... ...	80·6	—0·8	81·1	—0·3	83·4	+0·1	84·6	+0·6	84·4	+1·0
September ...	81·4	0·0	81·3	—0·1	83·0	—0·3	83·8	—0·2	83·9	+0·5
October ...	82·3	+0·9	81·9	+0·5	83·7	+0·4	83·7	—0·3	83·5	+0·1
November ...	80·7	—0·7	80·8	0—·6	83·2	—0·1	83·9	—0·1	83·4	0·0
December ...	78·5	—2·9	78·8	—2·6	81·6	—1·7	83·5	—0·5	83·0	—0·4
Year ...	81·4		81·4		83·3		84·0		83·4	

Extent of Cloudy Sky, 1890.

TABLE XI.—*Means of Estimations made at 6, 10, 14, 16, and 22 hours daily, the whole Sky being reckoned as 10.*

1890. Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	o	o	o	o	o	o	o	o	o	o	o	o
1		2·6			1·4	7·8	10·0	10·0	7·2	2·2	1·2	2·6
2		3·6	2·0		3·6	10·0	10·0	10·0	6·8	3·0	5·2	5·0
3			3·6	1·2	2·2	5·4	10·0	9·8	6·0	5·6	5·8	2·6
4		0·6	2·8	1·8	2·8	7·6	8·2	9·4	3·0	9·8	7·4	6·0
5		0·4	7·2	0·2	3·8	9·4	8·8	10·0	3·4	10·0	8·6	6·2
6			4·0	4·8	1·4	10·0	9·2	10·0	7·2	6·4	8·4	2·0
7			3·0	9·6	0·8	9·0	9·6	10·0	3·6	5·8	8·0	0·6
8		0·6	6·8	2·6	0·6	8·4	9·6	9·2	9·4	5·4	8·4	1·4
9		0·8	3·0	6·0	1·6	9·2	10·0	9·4	10·0	0·4	3·4	2·0
10			2·6	7·4	2·4	9·4	10·0	9·8	8·6	0·2	3·0	2·4
11			1·4	5·4	3·0	9·8	10·0	10·0	10·0	0·8	0·2	0·6
12			9·6	6·4	1·2	9·0	8·8	7·2	6·2	2·4	2·0	0·8
13			4·4	4·4	0·6	9·6	9·2	9·2	6·8	1·6	1·0	
14			0·2	4·4	1·8	10·0	7·6	10·0	7·8	2·0	0·6	
15		2·0		2·4	2·4	10·0	10·0	7·0	10·0	2·0		1·8
16		2·0	0·8	0·4	1·8	9·0	10·0	8·8	3·4	2·4		
17	2·8	2·2	0·8	0·8	2·8	9·4	9·6	9·8	5·4	1·4		1·0
18	0·2		2·2		1·4	10·0	9·8	8·6	7·8	1·4		4·6
19			2·2	0·6	1·8	10·0	10·0	8·8	8·2	0·4		0·6
20			0·6	0·4	1·2	9·4	10·0	10·0	10·0	0·2		1·4
21		2·0	1·0	3·6	2·0	10·0	10·0	9·6	10·0	0·2	0·4	
22			1·2	5·2	1·2	7·8	10·0	9·8	5·8		0·8	3·0
23	2·4		0·6	5·4	3·4	10·0	8·4	10·0	2·8	1·2	0·4	4·2
24	3·0	2·6	1·6	8·8	1·6	9·8	10·0	9·4	8·0	2·0	0·4	3·0
25		0·2	0·6	1·6	2·0	10·0	10·0	5·6	6·0	1·4		5·2
26	1·8	0·2	0·6	1·4	2·6	8·2	9·0	5·2	4·2	1·6		
27				0·2	3·4	9·0	9·6	7·6	8·8	3·4		
28		1·0			4·4	8·2	10·0	3·8	5·0	4·0		4·4
29			0·8		3·0	9·8	10·0	8·8	2·8	0·2	0·6	7·2
30	1·0			4·6	9·0	9·8	8·4	9·6	3·2		4·6	7·0
31			0·2		7·8		9·8	9·2		1·0		7·8
Monthly Mean.	0·4	0·7	2·1	3·0	2·5	9·2	9·5	8·9	6·6	2·5	2·3	2·7
Annual Variation ...	—3·8	—3·5	—2·1	—1·2	—1·7	+5·0	+5·3	+4·7	+2·4	—1·7	—1·9	—1·5

For the days which have no entry, 0·0 is to be understood.

Mean of the months from January to April, November and December ... ... 1·9

Mean of the months from May to October ... ... 6·5

Mean for the year ... ... 4·2

Rainfall, 1890.

TABLE XII.—*Total Fall of Rain (in inches) as measured by Newman's Gauge, placed 4½ feet above the ground.*

1890.	MONTH.											
Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
				in.	in.	in.	in.	in.	in.	in.	in.	in.
1						0·28	0·78	**2·49**				
2						0·41	0·34	0·55				
3						0·06	0·27	0·07				
4						0·42	0·09	0·12		**0·54**	0·02	
5							**0·03**	0·02		0·01	**1·18**	0·13
6						1·67	0·04	0·39			0·02	
7						0·45	0·36	1·54		0·03		
8							0·05	0·19	0·07		0·03	
9						0·09	0·65	0·16	0·34			
10						0·09	1·28	0·48	0·30			
11						0·03	0·41	0·32	**2·34**			
12						0·01	1·37	0·14	0·01			
13						0·66	0·34	0·10	0·03			
14						1·40	0·08	0·37	0·10			
15						2·19	1·23	0·38	2·20			
16						0·64	2·41	0·08	0·25			
17						0·66	0·26	0·15	0·64			
18						4·40	0·17	0·07	0·03			
19						**4·61**	0·83	0·09				
20						1·68	0·59	0·56	0·02			
21						1·02	**3·25**	0·15				
22						0·44	0·72	0·17				
23						0·48	1·13	0·12				
24				0·01		0·30	0·79	0·09	0·03			
25						0·46	0·36	0·03	0·03			
26						0·02	0·06	0·06	0·04			
27						0·04	0·15	0·60	0·01			
28						0·04	0·80		0·01			
29						0·27	1·74					
30					**0·05**	1·73	0·47	0·58				
31					0·01		0·49	0·54				
Monthly Total...				0·01	0·06	**24·55**	21·54	10·61	6·45	0·58	1·25	0·13
Number of rainy days ...				1	2	28	**31**	29	17	3	4	1

Total fall of rain in the year ... ... 65·18 inches.
Total Number of rainy days in the year 116
The greatest daily fall of rain in the year (that of 19th June) was ... ... 4·61 inches.
No rain fell in the months of January, February and March, nor on any of the days left blank in the above table.

Table XIII.—Five-day Means, 1890.

Number of Five-day Period.	Barometric Pressure.	Temperature of the Air.	Pressure of Vapour.	Additional Capacity of the Air.	Rainfall.*	North or South Component of Wind.	East or West Component of Wind.	Number of Five-day Period.	Barometric Pressure.	Temperature of the Air.	Pressure of Vapour.	Additional Capacity of the Air.	Rainfall.*	North or South Component of Wind.	East or West Component of Wind.
	In.	°	In.	In.	In.	Miles.	Miles.		In.	°	In.	In.	In.	Miles.	Miles.
1 ..	29·914	75·1	0·605	0·273		5·8 N.	0·4 E.	38 ...	29·724	80·8	0·875	0·177	1·13	6·0 S.	19·6 W.
2 ...	·934	75·0	·602	·272		4·1 N.	1·6 E.	39 ...	·685	80·3	·870	·164	3·48	3·4 S.	21·4 W.
3 ...	·887	75·8	·597	·304		5·2 N.	1·6 E.	40 ...	·644	78·9	·855	·134	4·90	3·7 S.	21·1 W.
4 ..	·908	75·8	·628	·270		4·4 N.	0·2 E.	41 ...	·580	78·9	·878	·109	6·48	3·2 S.	17·9 W.
5 ...	·916	78·5	·579	·251		9·7 N.	3·2 W.	42 ...	·683	79·2	·866	·134	3·11	7·4 S.	17·0 W.
6 ..	·892	75·2	·519	·366		6·8 N.	2·5 E.	43 ...	·704	78·7	·850	·132	4·07	4·1 S.	19·5 W.
7 ...	·993	76·1	·578	·327		7·2 N.	1·7 W.	44 ...	·677	78·8	·858	·127	2·26	0·5 N.	19·2 W.
8 ...	·963	75·2	·583	·295		10·6 N.	3·6 W.	45 ...	·707	78·7	·836	·148	1·20	5·4 S.	19·7 W.
9 ...	·924	78·0	·630	·336		6·4 N.	1·7 W.	46 ...	·776	78·9	·811	·178	1·05	2·0 S.	17·2 W.
10 ...	·838	76·4	·696	·216		5·7 N.	3·3 W.	47 ...	·802	78·3	·822	·148	1·09	1·9 S.	13·0 W.
11 ...	·871	78·8	·687	·302		5·7 N.	2·3 W.	48 ...	·821	79·4	·797	·208	0·78	1·2 N.	8·0 W.
12 ...	·867	78·8	·672	·317		9·0 N.	4·7 W.	49 ...	·809	78·5	·801	·176	1·12	5·1 S.	7·8 W.
13 ..	·922	77·9	·718	·238		3·7 N.	5·4 W.	50 ...	·793	79·6	·787	·226		1·2 N.	7·5 W.
14 ...	·857	78·2	·786	·281		0·9 N.	5·8 W.	51 ...	·681	79·2	·858	·140	3·06	3·1 N.	7·7 W.
15 ...	·831	78·7	·707	·280		8·0 N.	6·3 W.	52 ...	·748	78·6	·830	·149	3·22	1·5 S.	8·1 W.
16 ...	·780	80·8	·758	·297		10·6 N.	6·6 W.	53 ...	·818	79·8	·810	·208	0·05	3·5 N.	11·0 W.
17 ..	·797	80·2	·738	·298		13·4 N.	9·2 W.	54 ...	·818	80·1	·811	·218	0·11	2·3 N.	9·8 W.
18 ...	·860	80·0	·722	·306		11·4 N.	8·6 W.	55 ..	·859	80·5	·863	·180	0·01	7·4 N.	5·2 W.
19 ...	·829	80·2	·783	·353		3·7 N.	5·7 W.	56 ...	·843	79·1	·831	·165	0·58	3·1 N.	3·8 W.
20 ...	·861	81·7	·848	·236		3·2 N.	5·2 W.	57 ...	·782	81·5	·884	·193		4·1 N.	1·8 W.
21 ...	·777	83·4	·814	·333		5·0 N.	6·8 W.	58 ...	·843	81·0	·886	·176		4·7 N.	3·0 W.
22 ...	·759	82·2	·843	·262		7·9 N.	6·5 W.	59 ..	·929	78·7	·788	·195		6·9 N.	3·0 W.
23 ..	·734	83·8	·874	·288	0·01	2·6 S.	6·2 W.	60 ...	·897	80·3	·764	·276		6·4 N.	0·8 W.
24 ..	·765	82·8	·854	·270		5·5 N.	8·3 W.	61 ...	·845	79·8	·674	·348		7·1 N.	1·1 E.
25 ...	·747	83·9	·867	·299		9·5 N.	9·3 W.	62 ...	·819	79·0	·776	·219	1·22	1·6 N.	1·3 E.
26 ..	·732	83·1	·816	·321		1·0 N.	7·8 W.	63 ...	·905	79·8	·847	·173		2·9 N.	0·1 E.
27 ..	·821	83·1	·838	·297		3·2 N.	8·4 W.	64 ...	·929	79·3	·721	·285		4·4 N.	2·1 E.
28 ..	·749	83·2	·860	·278		3·5 N.	7·6 W.	65 ...	·980	77·4	·637	·309		4·8 N.	0·1 E.
29 ...	·750	84·5	·879	·308		3·1 S.	7·2 W.	66 ...	·976	77·7	·654	·302		3·1 N.	1·1 E.
30 ...	·749	85·6	·926	·305	0·05	4·4 S.	8·1 W.	67 ..	·920	77·3	·668	·275		3·5 N.	1·0 E.
31 ...	·621	83·2	·986	·235	1·18	19·3 S.	2·2 E.	68 ...	·896	76·8	·693	·232	0·13	3·6 N.	0·4 W.
32 ...	·655	82·5	·926	·188	2·21	6·7 S.	6·9 W.	69 ..	·920	77·6	·689	·260		8·0 N.	1·5 W.
33 ..	·611	82·1	·932	·165	2·19	10·6 S.	1·1 W.	70 ...	·928	74·0	·540	·307		8·5 N.	1·1 W.
34 ...	·603	78·7	·880	·104	12·50	14·5 S.	8·9 W.	71 ...	·971	74·9	·603	·266		8·1 N.	0·2 W.
35 ...	·616	80·6	·904	·141	3·92	10·2 S.	14·8 W.	72 ...	·990	76·6	·668	·251		6·7 N.	0·1 W.
36 ...	·687	82·0	·901	·193	0·83	8·7 S.	12·9 W.	73 ...	·994	76·4	·665	·248		5·8 N.	0·7 E.
37 ..	·660	80·6	·878	·165	3·21	7·8 S.	18·4 W.								

*Five-day sums, *not means*.

Meteorological Elements, 1886 to 1890.

TABLE XIV.— *Annual and Lustral Means.*

Year.	Barometric Pressure.	Temperature of Air.	Pressure of Vapour.	Additional Capacity.	Rainfall.*	Wind.	
						North Component.	East Component.
	in.	°	in.	in.	in.	Miles.	Miles.
1886	29·809	79·5	0·780	0·236	99·74	2·7 N.	4·9 W.
1887	·818	78·7	·759	·233	94·95	2·8 N.	5·5 W.
1888	·832	80·1	·794	·244	57·82	1·7 N.	5·8 W.
1889	·818	79·6	·787	·234	67·84	2·5 N.	5·2 W.
1890	·814	79·3	·771	·237	65·18	2·1 N.	6·3 W.
Mean...	29·818	79·4	0·778	0·237	77·11	2·4 N.	5·5 W.

*Sums, not means.

TABLES OF RESULTS

OF

ABSOLUTE MAGNETICAL OBSERVATIONS

1890.

B 1210—1

Absolute Magnetical Observations.—Table I.

Observations of Vibration and Deflection, taken with the Kew Unifilar Magnetometer (No. 23, by Elliott Brothers), for the determination of Absolute Horizontal Force.

1890.

1890. Date.	Civil Time. Mean.	Magnet N. 23 *a*. Time of one Vibration.	Effect of 90° Torsion.	Temperature.	Rate of Chronometer.	Corresponding Mean Reading of L. H. F. Magnetometer. Scale Reading.	Thermometer.	Angle of Deflection of Magnet N. 23 *c* by N. 23 *a* at Distance. 0·8 foot.	1·0 foot.	Temperature.	Corresponding Mean Reading of L. H. F. Magnetometer. Scale Reading.	Thermometer.	Observer.	Calculated Results in English Units. Values of m.	Values of X. From Deflections at distance. 0·8 foot ($X_{0\cdot8}$)	1·0 foot ($X_{1\cdot0}$)	Difference. $X_{0\cdot8} - X_{1\cdot0}$	Mean. $\frac{X_{0\cdot8}+X_{1\cdot0}}{2}$	Monthly Mean Values of X.	Monthly Mean Values of X in Metrical Units.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
	h. m.	s.	Sc. div.	°	s.		°	° ′ ″	° ′ ″	°		°								
JANUARY 1	12 17	2·8330	1·30	86·1	+10·9	15·45	81·1	17 34 35	8 56 2	86·5	15·42	81·9	V.G.G.	·64102	8·1169	8·1154	+·0015	8·1161		
„ „	15 19	2·8332	1·28	85·0	+10·9	15·23	83·8	17 34 40	8 56 3	87·1	15·30	83·2	V.G.G.	·64093	8·1147	8·1133	+·0014	8·1140		
„ 8	13 28	2·8321	1·24	85·8	+11·8	16·04	80·4	17 34 41	8 56 0	84·9	15·90	81·0	G.S.J.	·64105	8·1206	8·1197	+·0009	8·1201		
„ „	15 41	2·8331	1·15	85·2	+11·8	15·56	82·7	17 34 35	8 55 55	85·4	15·67	81·9	G.S.J.	·64083	8·1175	8·1167	+·0008	8·1171		
„ 15	12 10	2·8324	1·19	86·0	+11·6	16·25	81·1	17 33 42	8 55 25	86·1	16·07	81·7	V.G.G.	·64075	8·1227	8·1225	+·0002	8·1226		
„ „	15 17	2·8330	1·22	84·7	+11·6	15·46	83·8	17 34 0	8 55 32	86·9	15·65	82·9	V.G.G.	·64072	8·1178	8·1178	·0000	8·1178	8·1197	3·7438
„ 22	12 17	2·8305	1·27	80·6	+10·2	16·44	79·0	17 35 33	8 56 15	80·7	16·15	79·8	G.S.J.	·64088	8·1212	8·1218	−·0006	8·1215		
„ „	15 22	2·8315	1·21	81·2	+10·2	15·84	80·9	17 35 35	8 56 15	81·3	15·89	80·4	G.S.J.	·64081	8·1184	8·1190	−·0006	8·1187		
„ 29	12 12	2·8307	1·28	83·8	+11·8	16·85	78·4	17 34 10	8 55 37	83·7	16·60	79·5	V.G.G.	·64093	8·1259	8·1261	−·0002	8·1260		
„ „	15 18	2·8324	1·28	87·0	+11·8	16·07	81·4	17 33 40	8 55 20	86·3	16·29	80·9	V.G.G.	·64091	8·1233	8·1236	−·0003	8·1234		
FEBRUARY 5	12 16	2·8307	1·36	82·7	+10·6	16·68	79·7	17 35 0	8 56 5	82·4	16·44	80·2	G.S.J.	·64097	8·1229	8·1225	+·0004	8·1227		
„ „	15 23	2·8318	1·29	82·1	+10·6	15·83	82·0	17 35 11	8 56 12	83·3	16·00	81·3	G.S.J.	·64093	8·1178	8·1173	+·0005	8·1175		
„ 12	12 9	2·8331	1·31	88·0	+10·8	16·21	81·7	17 33 12	8 55 15	87·2	16·02	82·5	V.G.G.	·64068	8·1229	8·1221	+·0008	8·1225		
„ „	15 16	2·8334	1·34	87·8	+10·8	15·31	85·0	17 33 30	8 55 22	88·7	15·52	84·2	V.G.G.	·64084	8·1193	8·1188	+·0005	8·1190		
„ 19	12 15	2·8328	1·22	84·6	+10·3	16·05	80·4	17 34 36	8 55 53	83·9	16·10	81·2	G.S.J.	·64078	8·1186	8·1182	+·0004	8·1184	8·1194	3·7437
„ „	15 25	2·8331	1·12	83·4	+10·3	15·36	82·9	17 35 7	8 56 5	84·3	15·60	82·3	G.S.J.	·64081	8·1147	8·1148	−·0001	8·1147		
„ 26	12 8	2·8331	1·08	86·0	+10·8	16·38	81·8	17 33 22	8 55 17	85·4	16·27	82·6	V.G.G.	·64052	8·1227	8·1223	+·0004	8·1225		
„ „	15 16	2·8333	1·05	85·0	+10·8	15·64	84·1	17 33 52	8 55 30	86·5	15·81	83·6	V.G.G.	·64066	8·1184	8·1182	+·0002	8·1183		
MARCH 4	12 13	2·8315	1·07	86·8	+10·9	16·21	83·0	17 33 13	8 55 11	86·6	16·01	83·3	G.S.J.	·64088	8·1272	8·1270	+·0002	8·1271		
„ „	15 11	2·8335	1·11	86·3	+10·9	15·26	84·5	17 33 32	8 55 23	87·0	15·53	84·0	G.S.J.	·64071	8·1197	8·1191	+·0006	8·1194		
„ 12	12 10	2·8322	1·12	85·8	+11·8	16·41	82·0	17 33 6	8 55 12	85·7	16·21	82·6	V.G.G.	·64060	8·1259	8·1249	+·0010	8·1254		
„ „	15 13	2·8328	1·15	84·9	+11·8	15·66	83·4	17 33 2	8 55 10	87·1	15·89	82·7	V.G.G.	·64059	8·1219	8·1212	+·0007	8·1215		
„ 19	12 12	2·8336	0·96	87·4	+10·8	15·48	84·3	17 33 30	8 55 21	87·7	15·36	84·8	G.S.J.	·64068	8·1199	8·1195	+·0004	8·1197	8·1219	3·7448
„ „	15 22	2·8338	1·00	87·4	+10·8	15·04	85·7	17 34 3	8 55 35	88·0	15·08	85·4	G.S.J.	·64083	8·1171	8·1169	+·0002	8·1170		
„ 27	12 5	2·8326	1·02	86·3	+11·3	16·16	83·0	17 33 10	8 55 5	86·5	15·99	83·4	V.G.G.	·64059	8·1240	8·1244	−·0004	8·1242		
„ „	15 13	2·8332	1·00	85·9	+11·3	15·44	83·7	17 33 27	8 55 15	86·8	15·63	83·7	V.G.G.	·64068	8·1206	8·1208	−·0002	8·1207		

1890. Date.	Civil Time. Mean.	Magnet N. 23 a. Time of one Vibration.	Effect of 90° Torsion.	Temperature.	Rate of Chronometer.	Corresponding Mean Reading of L. H. F. Magnetometer. Scale Reading.	Thermometer.	Angle of Deflection of Magnet N. 23 c by N. 23 a at Distance. 0·8 foot.	1·0 foot.	Temperature.	Corresponding Mean Reading of L. H. F. Magnetometer. Scale Reading.	Thermometer.	Observer.	Calculated Results in English Units. Values of m.	Values of X. From Deflections at distance. 0·8 foot ($X_{0\cdot8}$)	1·0 foot ($X_{1\cdot0}$)	Difference. $X_{0\cdot8}-X_{1\cdot0}$	Mean. $\frac{X_{0\cdot8}+X_{1\cdot0}}{2}$	Monthly Mean Values of X.	Monthly Mean Values of X in Metrical Units.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
	h. m.	s.	Sc. div.	°	s.		°	° ′ ″	° ′ ″	°		°								
April 2	12 11	2·8327	0·99	87·0	+10·2	15·97	83·6	17 32 57	8 54 55	87·2	15·75	84·0	V. G. G.	·64056	8·1246	8·1253	−·0007	8·1249		
„ „	15 14	2·8332	1·02	86·5	+10·2	15·14	85·0	17 33 17	8 55 2	88·2	15·41	84·9	V. G. G.	·64075	8·1204	8·1218	−·0014	8·1211		
„ 9	12 12	2·8326	0·94	88·3	+9·5	15·70	85·1	17 32 25	8 54 40	88·8	15·50	85·3	V. G. G.	·64060	8·1264	8·1270	−·0006	8·1267		
„ „	15 16	2·8335	0·95	86·6	+9·5	14·89	86·9	17 32 42	8 54 50	90·2	15·27	86·2	V. G. G.	·64063	8·1203	8·1206	−·0003	8·1204		
„ 16	12 15	2·8340	0·98	88·0	+9·9	15·34	85·6	17 33 7	8 55 7	88·2	15·19	86·0	C.	·64052	8·1203	8·1201	+·0002	8·1202	8·1212	3·7445
„ „	15 22	2·8341	0·90	86·7	+9·9	14·92	86·6	17 33 36	8 55 20	88·4	15·07	86·1	C.	·64062	8·1169	8·1169	·0000	8·1169		
„ 23	12 13	2·8349	0·94	91·2	+9·4	14·95	87·5	17 32 42	8 54 50	90·7	14·89	87·9	V. G. G.	·64060	8·1195	8·1201	−·0006	8·1198		
„ „	15 16	2·8342	0·91	88·6	+9·4	14·67	87·7	17 32 40	8 54 50	91·2	14·79	87·8	V. G. G.	·64069	8·1191	8·1195	−·0004	8·1193		
„ 30	11 57	2·8337	0·98	90·6	+9·4	15·43	86·9	17 32 1	8 54 35	90·2	15·33	87·0	C.	·64059	8·1255	8·1253	+·0002	8·1254		
„ „	15 6	2·8352	0·92	88·0	+9·4	14·76	88·1	17 32 37	8 54 52	89·8	15·04	87·7	C.	·64038	8·1173	8·1173	·0000	8·1173		
May 7	12 8	2·8359	0·90	91·7	+10·5	14·95	87·0	17 32 25	8 54 45	91·8	14·85	87·1	V. G. G.	·64040	8·1173	8·1175	−·0002	8·1174		
„ „	15 15	2·8360	0·90	91·0	+10·5	14·45	88·0	17 31 45	8 54 22	93·0	14·69	87·9	V. G. G.	·64035	8·1178	8·1182	−·0004	8·1180		
„ 14	12 18	2·8340	0·91	89·1	+11·1	15·28	86·7	17 32 51	8 54 56	89·3	15·17	86·9	G. S. J.	·64060	8·1214	8·1218	−·0004	8·1216		
„ „	15 25	2·8343	0·85	88·5	+11·1	14·85	87·8	17 32 54	8 54 58	90·1	14·96	87·3	G. S. J.	·64062	8·1191	8·1193	−·0002	8·1192	8·1216	3·7447
„ 21	12 11	2·8341	0·87	91·5	+10·3	15·45	86·7	17 31 27	8 54 17	91·4	15·29	87·1	V. G. G.	·64047	8·1262	8·1262	·0000	8·1262		
„ „	15 16	2·8346	0·89	91·7	+10·3	14·61	88·0	17 31 32	8 54 17	92·7	14·97	87·8	V. G. G.	·64069	8·1234	8·1238	−·0004	8·1236		
„ 28	12 14	2·8343	0·91	93·4	+9·4	15·26	89·2	17 31 8	8 54 4	93·6	15·15	89·6	G. S. J.	·64062	8·1262	8·1268	−·0006	8·1265		
„ „	15 22	2·8361	0·96	93·1	+9·4	14·50	90·2	17 31 14	8 54 6	94·4	14·75	89·9	G. S. J.	·64040	8·1197	8·1203	−·0006	8·1200		
June 4	12 52	2·8357	0·90	90·1	+9·3	15·02	86·8	17 32 52	8 54 50	90·2	14·90	87·0	V. G. G.	·64031	8·1163	8·1175	−·0012	8·1169		
„ „	15 10	2·8358	0·87	90·2	+9·3	14·59	87·6	17 33 10	8 55 2	90·8	14·74	87·3	V. G. G.	·64053	8·1145	8·1152	−·0007	8·1148		
„ 11	12 6	2·8332	0·77	90·0	+8·6	15·82	85·5	17 31 20	8 54 11	90·5	15·66	85·8	G. S. J.	·64047	8·1289	8·1292	−·0003	8·1290		
„ „	15 16	2·8344	0·70	88·6	+8·6	14·97	86·0	17 32 7	8 54 37	90·1	15·22	86·0	G. S. J.	·64050	8·1219	8·1218	+·0001	8·1218	8·1223	3·7450
„ 18	12 20	2·8324	0·76	83·8	+9·7	16·07	82·0	17 33 15	8 55 15	82·9	16·01	82·0	V. G. G.	·64031	8·1261	8·1253	+·0008	8·1257		
„ „	15 16	2·8327	0·73	81·2	+9·7	15·58	81·7	17 33 45	8 55 27	82·5	15·82	81·9	V. G. G.	·64034	8·1214	8·1212	+·0002	8·1213		
„ 25	12 7	2·8324	0·66	85·9	+9·0	15·80	83·5	17 32 40	8 54 51	86·1	15·66	83·7	G. S. J.	·64047	8·1270	8·1274	−·0004	8·1272		
„ „	15 17	2·8341	0·64	86·7	+9·0	15·16	84·4	17 32 35	8 54 51	87·2	15·33	84·2	G. S. J.	·64032	8·1219	8·1219	·0000	8·1219		
July 2	12 6	2·8337	0·63	85·0	+9·2	15·75	83·1	17 32 25	8 54 47	85·9	15·69	83·4	V. G. G.	·64010	8·1238	8·1236	+·0002	8·1237		
„ „	15 19	2·8343	0·62	84·5	+9·2	15·13	83·9	17 32 37	8 54 52	86·4	15·51	83·8	V. G. G.	·64019	8·1203	8·1201	+·0002	8·1202		
„ 9	12 10	2·8318	0·59	83·8	+8·5	15·84	82·7	17 32 47	8 54 59	83·8	15·84	82·6	G. S. J.	·64041	8·1287	8·1285	+·0002	8·1286		
„ „	15 19	2·8335	0·61	85·0	+8·5	15·44	83·3	17 32 43	8 54 58	84·9	15·66	83·0	G. S. J.	·64025	8·1242	8·1236	+·0006	8·1239		
„ 16	12 14	2·8328	0·60	83·0	+7·3	15·95	81·3	17 33 6	8 55 11	84·0	15·75	81·9	V. G. G.	·64018	8·1236	8·1229	+·0007	8·1232	8·1242	3·7459
„ „	15 14	2·8333	0·62	81·0	+7·3	15·33	81·6	17 33 55	8 55 37	82·3	15·48	81·9	V. G. G.	·64021	8·1191	8·1182	+·0009	8·1186		
„ 23	12 17	2·8331	0·61	83·9	+9·0	15·89	81·4	17 32 15	8 54 40	84·6	15·84	81·9	G. S. J.	·64003	8·1264	8·1264	·0000	8·1264		
„ „	15 26	2·8345	0·59	85·0	+9·0	15·18	82·8	17 32 55	8 55 2	85·4	15·48	82·5	G. S. J.	·64015	8·1201	8·1199	+·0002	8·1200		
„ 30	12 14	2·8334	0·61	83·8	+9·7	16·21	81·1	17 30 55	8 54 0	84·4	16·11	81·7	V. G. G.	·63951	8·1306	8·1306	·0000	8·1306		
„ „	15 13	2·8343	0·61	84·9	+9·7	15·56	82·7	17 31 19	8 54 10	85·3	15·82	82·5	V. G. G.	·63968	8·1264	8·1268	−·0004	8·1266		

Aug.	6	12 14	2·8319	0·60	83·7	+9·6	16·14	81·6	17 31 50	8 54 28	83·9	15·95	81·9	G. S. J.	·64003	8·1319	8·1319	·0000	8·1319	
,,	,,	15 22	2·8333	0·58	82·9	+9·6	15·49	82·2	17 32 17	8 54 43	83·7	15·70	82·3	G. S. J.	·63997	8·1257	8·1255	+·0002	8·1256	
,,	13	12 20	2·8331	0·57	85·1	+9·7	15·96	81·3	17 32 12	8 54 40	84·8	15·86	81·9	V. G. G.	·64010	8·1276	8·1274	+·0002	8·1275	
,,	,,	15 15	2·8339	0·60	83·9	+9·7	15·35	82·2	17 32 32	8 54 47	84·8	15·59	82·1	V. G. G.	·64003	8·1229	8·1231	−·0002	8·1230	8·1236
,,	20	12 13	2·8338	0·60	83 4	+10·3	15·34	81·6	17 33 49	8 55 31	82·7	15·16	81·7	G. S. J.	·64009	8·1199	8·1195	+·0004	8·1197	
,,	,,	15 19	2·8335	0·56	80·4	+10·3	15·06	81·9	17 34 13	8 55 45	83·7	14·86	81·9	G. S. J.	·64015	8·1160	8·1152	+·0008	8·1156	
,,	27	12 15	2·8330	0·54	84·8	+9·7	15·72	81·5	17 32 25	8 54 52	84·6	15·52	82·0	V. G. G.	·64012	8·1268	8·1261	+·0007	8·1264	
,,	,,	15 20	2·8340	0·52	83·5	+9·7	15·08	82·5	17 33 10	8 55 12	85·8	15·17	82·1	V. G. G.	·64019	8·1191	8·1186	+·0005	8·1188	
Sept.	3	12 13	2·8348	0·64	85·7	+9·6	15·32	81·9	17 32 44	8 55 0	85·2	15·36	82·3	G. S. J.	·64001	8·1206	8·1199	+·0007	8·1202	
,,	,,	15 13	2·8348	0·67	85·7	+9 6	15·14	83·2	17 32 17	8 54 50	85·6	15·40	83·0	G. S. J.	·63997	8·1218	8·1208	+·0010	8·1213	
,,	10	12 16	2·8347	0·58	86·9	+8·9	15·34	83·3	17 31 47	8 54 37	86·9	15·25	83·9	V. G. G.	·63994	8·1238	8·1225	+·0013	8·1231	
,,	,,	15 16	2·8350	0·60	86·2	+8·9	14·91	84·5	17 32 30	8 54 55	87·5	15·04	84·3	V. G. G.	·64012	8·1193	8·1184	+·0009	8·1188	8·1187
,,	17	12 13	2·8357	0·59	86·8	+9·2	15·13	82·3	17 32 57	8 55 8	86·0	15·03	82·7	G. S. J.	·63994	8·1175	8·1167	+·0008	8·1171	
,,	,,	15 23	2·8360	0·60	86·2	+9·2	14·69	83·6	17 33 3	8 55 13	86·5	14·85	83·2	G. S. J.	·63997	8·1152	8·1141	+·0011	8·1146	
,,	24	12 19	2·8347	0·60	82·8	+9·6	15·48	82·6	17 32 52	8 55 7	83·8	15·38	82·8	V. G. G.	·63971	8·1191	8·1182	+·0009	8·1186	
,,	,,	15 20	2·8354	0·58	84 7	+9·6	15·06	83·1	17 33 17	8 55 22	84·7	15·17	83·0	V. G. G.	·63997	8·1165	8·1152	+·0013	8·1158	
Oct.	1	12 12	2·8344	0·58	87·1	+8·7	15·30	84·1	17 31 28	8 54 31	87·0	15·47	84·6	G. S. J.	·64007	8·1261	8·1244	+·0017	8·1252	
,,	,,	15 21	2·8350	0·59	85·9	+8·7	15·02	85·3	17 32 7	8 54 46	86·9	15·23	85·2	G. S. J.	·63999	8·1210	8·1197	+·0013	8·1203	
,,	8	12 20	2·8346	0·56	86·4	+9·0	15·45	83·1	17 32 42	8 55 0	86·5	15·30	83·6	V. G. G.	·64012	8·1208	8·1201	+·0007	8·1204	
,,	,,	15 22	2·8351	0·58	86·7	+9·0	14·94	84·7	17 32 22	8 54 50	87·5	15·10	84·3	V. G. G.	·64007	8·1199	8·1191	+·0008	8·1195	
,,	15	12 14	2·8350	0·65	90·0	+9·6	15·22	85·6	17 31 22	8 54 14	89·0	15·13	85·8	G.S. J.	·64003	8·1255	8·1255	·0000	8·1255	8·1207
,,	,,	15 18	2·8379	0·67	88·5	+9·6	13·80	86·4	17 32 40	8 54 53	89·7	14·35	86·1	G. S. J.	·63997	8·1102	8·1102	·0000	8·1102	
,,	22	12 22	2·8342	0·61	86·2	+10·9	15·49	82·9	17 32 42	8 54 51	85·7	15·29	83·2	V. G. G.	·64006	8·1227	8·1231	−·0004	8·1229	
,,	,,	15 20	2·8350	0·64	85·3	+10·9	14·82	84·5	17 32 45	8 54 52	86·4	15·04	84·0	V. G. G.	·64003	8·1188	8·1191	−·0003	8·1189	
,,	29	12 6	2·8347	0·70	88·2	+11·5	15·82	83·7	17 31 35	8 54 22	86·9	15·54	84·5	G. S. J.	·63984	8·1257	8·1255	+·0002	8·1256	
,,	,,	15 14	2·8355	0·74	87·0	+11·5	14·83	85·8	17 32 20	8 54 46	87·5	15·05	85·3	G. S. J.	·64001	8·1191	8·1188	+·0003	8·1189	
Nov.	5	12 21	2·8348	0·76	90·0	+10·5	15·27	85·7	17 31 55	8 54 37	88·6	15·05	85·9	V. G. G.	·64016	8·1242	8·1234	+·0008	8·1238	
,,	,,	15 19	2·8352	0·79	86·9	+10·5	14·78	86·2	17 32 0	8 54 40	88·7	14·80	86·2	V. G. G.	·63999	8·1199	8·1190	+·0009	8·1194	
,,	12	12 8	2·8353	0·82	89·2	+10·0	15·42	83·5	17 31 8	8 54 11	88·4	15·23	84·2	G. S. J.	·63978	8·1249	8·1246	+·0003	8·1247	
,,	,,	15 20	2·8366	0·92	88·1	+10·0	14·48	86·0	17 32 2	8 54 43	89·3	14·76	85·2	G. S. J.	·63987	8·1158	8·1147	+·0011	8·1152	
,,	19	12 12	2·8351	0·86	86·3	+11·5	15·63	83·0	17 32 12	8 54 47	85·7	15·45	83·2	V. G. G.	·63972	8·1216	8·1204	+·0012	8·1210	8·1200
,,	,,	15 19	2·8362	0·89	84·8	+11·5	14·76	84·7	17 32 15	8 54 45	86·6	15·05	84·2	V. G. G.	·63962	8·1160	8·1154	+·0006	8·1157	
,,	26	12 39	2·8349	0·59	87·9	+11·6	15·80	83·0	17 31 50	8 54 35	87·5	15·61	83·3	G. S. J.	·63994	8·1236	8·1227	+·0009	8·1231	
,,	,,	15 21	2·8366	0·58	88·0	+11·6	15·06	84·7	17 31 57	8 54 37	88·3	15·33	84·1	G. S. J.	·63981	8·1178	8·1171	+·0007	8·1174	
Dec.	3	13 8	2·8357	0·63	87·1	+11·8	15·66	82·2	17 32 25	8 54 49	86·6	15·48	82·9	V. G. G.	·63984	8·1193	8·1190	+·0003	8·1191	
,,	,,	15 15	2·8359	0·63	84·9	+11·8	15·20	84·0	17 32 30	8 54 50	86·5	15·32	83·6	V. G. G.	·63971	8·1167	8·1163	+·0004	8·1165	
,,	10	12 6	2·8347	0·56	85·7	+11·0	15·73	82·8	17 32 46	8 54 56	85·1	15·53	83·2	G. S. J.	·63990	8·1210	8·1210	·0000	8·1210	
,,	,,	15 21	2·8348	0·55	83·7	+11·0	15·05	84·2	17 32 56	8 55 3	85·7	15·26	83·9	G. S. J.	·64001	8·1180	8·1176	+·0004	8·1178	
,,	17	12 13	2·8342	0·59	84·0	+13·2	16·42	79·8	17 32 42	8 54 55	83·6	16·27	80·1	V. G. G.	·63982	8·1231	8·1229	+·0002	8·1230	
,,	,,	15 17	2·8341	0·61	81·7	+13·2	15·93	81·6	17 33 17	8 55 10	82·5	16·07	80·9	V. G. G.	·63982	8·1199	8·1201	−·0002	8·1200	8·1203
,,	24	12 17	2·8352	0·61	87·0	+11·3	16·19	82·1	17 30 59	8 54 6	87·1	15·90	82·9	V. G. G.	·63951	8·1257	8·1253	+·0004	8·1255	
,,	,,	15 20	2·8357	0·60	87·6	+11·3	15·20	84·0	17 31 35	8 54 22	88·3	15·42	83·8	V. G. G.	·63987	8·1214	8·1212	+·0002	8·1213	
,,	31	12 12	2·8353	0·56	85·1	+11·6	16·09	80·6	17 31 57	8 54 30	85 0	15·92	81·2	V. G. G.	·63951	8·1221	8·1223	−·0002	8·1222	
,,	,,	15 21	2 8355	0·59	83·1	+11·6	15·37	83·0	17 32 42	8 54 50	85·6	15·57	82·4	V. G. G.	·63966	8·1163	8·1169	−·0006	8·1166	

The mean value of the Horizontal Force for the year 1890 = 8·1211

3·7456	
3·7434	
3·7443	
3·7440	
3·7441	
3·7445	

Absolute Magnetical Observations.—Table II.

Observations of Absolute Declination.

1890.

1890. Date.	Bombay Civil Time.	Mean Readings. Collimator Magnet. Scale apparently Erect.	Collimator Magnet. Scale apparently Inverted.	Horizontal Circle with Telescope pointed to Scale of Collimator Magnet.	Horizontal Circle with Telescope pointed to Tárdeo Chimney.	Torsion. Mean.	Torsion. Effect of 90°.	Observer.	Corresponding Reading of large Declination Magnetometer.	Absolute Easterly Declination corrected for Torsion.	Monthly Mean. Corresponding Reading of large Declination Magnetometer.	Monthly Mean. Absolute Easterly Declination.
1	2	3	4	5	6	7	8	9	10	11	12	13
	h. m.	Sc. div.	Sc. div.	° ′ ″	° ′ ″	°	Sc. div.		Sc. div.	° ′ ″	Sc. div.	° ′ ″
JAN. 2	11 29	+1·51	+1·70	17 14 25	196 53 0	10 E	0·54	V.G.G.	35·65	0 47 31		
,, 9	11 19	+1·47	+1·60	17 14 15	196 53 10	0		G.S.J.	35·60	0 47 23		
,, 16	11 36	+1·51	+1·59	17 14 40	196 53 0	0		V.G.G.	35·68	0 48 0	35·67	0 47 48
,, 23	11 22	+1·50	+1·60	17 14 25	196 52 27	0		G.S.J.	35·74	0 48 17		
,, 30	11 33	+1·47	+1·65	17 13 40	196 52 5	0		V.G.G.	35·69	0 47 49		
FEB. 6	11 27	+1·50	+1·57	17 15 10	196 52 32	0		G.S.J.	35·85	0 49 0		
,, 13	11 34	+1·50	+1·66	17 14 0	196 52 20	0		V.G.G.	35·67	0 47 55	35·78	0 48 35
,, 20	11 24	+1·52	+1·57	17 14 15	196 51 50	0		G.S.J.	35·83	0 48 48		
,, 27	11 27	+1·46	+1·72	17 14 20	196 51 50	0		V.G.G.	35·79	0 48 38		
MARCH 5	11 31	+1·52	+1·59	17 13 55	196 52 10	0		G.S.J.	35·73	0 48 7		
,, 13	11 24	+1·51	+1·60	17 13 10	196 51 40	0		V.G.G.	35·67	0 47 50	35·60	0 47 29
,, 20	11 30	+1·52	+1·54	17 12 45	196 51 20	0		G.S.J.	35·65	0 47 50		
,, 28	11 37	+1·52	+1·64	17 11 20	196 51 30	0		V.G.G.	35·37	0 46 8		
APRIL 3	11 36	+1·50	+1·66	17 13 25	196 51 40	0		V.G.G.	35·66	0 48 0		
,, 10	11 32	+1·50	+1·67	17 13 0	196 52 0	0		V.G.G.	35·57	0 47 15	35·50	0 46 47
,, 17	11 35	+1·52	+1·60	17 11 40	196 52 0	0		C.	35·40	0 46 0		
,, 24	11 28	+1·51	+1·67	17 11 40	196 52 0	0		V.G.G.	35·38	0 45 55		
MAY 1	11 31	+1·56	+1·60	17 12 5	196 52 0	10 W	0·92	C.	35·49	0 46 42		
,, 8	11 33	+1·51	+1·56	17 13 0	196 52 40	0		V.G.G.	35·49	0 46 43		
,, 15	11 25	+1·51	+1·65	17 13 0	196 53 10	0		G.S.J.	35·38	0 46 6	35·40	0 46 9
,, 22	11 29	+1·49	+1·71	17 12 10	196 52 35	0		V.G.G.	35·34	0 45 46		
,, 29	11 30	+1·55	+1·54	17 11 10	196 52 7	0		G.S.J.	35·32	0 45 29		
JUNE 5	11 28	+1·50	+1·62	17 13 0	196 52 35	0		V.G.G.	35·49	0 46 43		
,, 12	11 28	+1·49	+1·66	17 11 35	196 52 25	0		G.S.J.	35·31	0 45 25		
,, 19	11 33	+1·52	+1·56	17 10 20	196 52 0	0		V.G.G.	35·19	0 44 43	35·33	0 45 34
,, 26	11 25	+1·54	+1·55	17 12 5	196 53 5	0		G.S.J.	35·32	0 45 26		
JULY 3	11 32	+1·50	+1·66	17 11 20	196 52 45	0		V.G.G.	35·21	0 44 50		
,, 10	11 21	+1·52	+1·61	17 10 50	196 52 25	0		G.S.J.	35·19	0 44 45		
,, 17	11 30	+1·46	+1·80	17 11 55	196 52 45	0		V.G.G.	35·25	0 45 13	35·24	0 45 5
,, 24	11 27	+1·55	+1·50	17 11 0	196 51 55	0		G.S.J.	35·33	0 45 34		
AUG. 1	11 30	+1·52	+1·65	17 10 45	196 52 0	0		V.G.G.	35·24	0 45 3		
,, 8	11 24	+1·52	+1·61	17 11 50	196 52 35	0		G.S.J.	35·29	0 45 35		
,, 14	11 35	+1·49	+1·69	17 10 20	196 51 40	0		V.G.G.	35·17	0 44 52	35·25	0 45 16
,, 21	11 30	+1·55	+1·59	17 10 50	196 51 40	0		G S.J.	35·29	0 45 33		
,, 28	11 52	+1·51	+1·69	17 11 0	196 51 55	0		V.G.G.	35·24	0 45 19		
SEPT. 4	11 32	+1·47	+1·69	17 10 55	196 51 27	10 W	0·59	G.S.J.	35·35	0 45 48		
,, 11	11 36	+1·51	+1·60	17 9 30	196 51 55	0		V.G.G.	35·09	0 43 55	35·17	0 44 34
,, 19	11 20	+1·44	+1·79	17 10 30	196 52 25	0		G.S.J.	35·10	0 44 8		
,, 25	11 40	+1·54	+1·57	17 10 0	196 52 0	0		V.G.G.	35·15	0 44 25		
OCT. 2	11 27	+1·52	+1·66	17 12 20	196 51 30	0		G.S.J.	35·56	0 47 6		
,, 9	11 32	+1·50	+1·64	17 11 30	196 52 0	0		V.G.G.	35·38	0 45 46		
,, 16	11 25	+1·52	+1·61	17 10 40	196 51 50	0		G.S.J.	35·27	0 45 10	35·37	0 45 49
,, 24	11 37	+1·49	+1·65	17 12 0	196 52 2	0		V.G.G.	35·41	0 46 13		
,, 30	11 32	+1·52	+1·60	17 9 50	196 51 20	0		G.S.J.	35·21	0 44 50		
NOV. 6	11 33	+1·59	+1·50	17 10 45	196 52 15	0		V.G.G.	35·24	0 45 2		
,, 14	11 23	+1·55	+1·57	17 12 30	196 51 52	0		G.S.J.	35·56	0 47 3	35·44	0 46 18
,, 20	11 32	+1·54	+1·60	17 12 20	196 52 20	0		V.G.G.	35·47	0 46 22		
,, 27	11 25	+1·49	+1·64	17 12 50	196 52 20	0		G S.J.	35·51	0 46 46		
DEC. 4	11 31	+1·60	+1·47	17 13 45	196 53 0	0		V.G.G.	35·58	0 47 19		
,, 11	11 20	+1·52	+1·60	17 11 30	196 52 30	0		G.S.J.	35·31	0 45 20	35·56	0 47 4
,, 18	11 32	+1·47	+1·72	17 14 0	196 53 0	0		V.G.G.	35·57	0 47 9		
,, 25	11 42	+1·52	+1·65	17 15 10	196 53 0	0		V.G.G.	35·78	0 48 28		

The Mean Declination for the year 1890 = 0 46 22

Absolute Magnetical Observations.—Table III.

OBSERVATIONS OF INCLINATION, 1890.

Taken with Barrow's Dip Circle, with Microscopes, No. 49 and two 3½-inch Needles, Nos. 1 and 2, by Dover, Charlton.

1890. Date.	Bombay Civil Time (0 to 24 hours). At commencement.	At conclusion.	Observer.	Needle marked.	End of Needle Dipping. A. Face of Circle. East.	A. Face of Circle. West.	B. Face of Circle. East.	B. Face of Circle. West.	Mean Dip.	Monthly Mean for each Needle.	Monthly Mean.
	h. m.	h. m.			° ′	° ′	° ′	° ′	° ′		° ′
JAN. 3	14 59	16 23	V.G.G.	1	20 40·6	20 54·2	19 40·0	20 3·2	20 19·5		
„ 7	12 23	13 45	G.S.J.	1	20 40·9	20 58·5	19 43·0	20 0·8	20 20·8	No. 1	
„ 10	14 43	16 1	G.S.J.	2	20 29·5	20 46·7	19 56·9	20 16·1	20 22·3	20 20·5	
„ 14	12 24	13 55	V.G.G.	2	20 25·2	20 48·7	19 48·5	20 16·5	20 19·7		
„ 17	14 50	16 27	V.G.G.	1	20 38·4	21 2·5	19 37·5	20 1·4	20 19·9		20 20·7
„ 21	12 22	13 41	G.S.J.	1	20 39·3	20 58·2	19 46·7	20 3·4	20 21·9	No. 2	
„ 24	14 38	16 1	G.S.J.	2	20 27·4	20 46·5	19 56·4	20 14·6	20 21·2	20 20·9	
„ 28	12 20	13 43	V.G.G.	2	20 26·9	20 55·1	19 50·7	20 9·2	20 20·5		
„ 31	14 55	16 24	V.G.G.	1	20 33·6	21 2·1	19 41·2	20 4·2	20 20·3		
FEB. 4	12 25	13 52	G.S.J.	1	20 33·5	20 57·6	19 37·2	20 3·2	20 17·9		
„ 7	14 37	15 58	G.S.J	2	20 25·9	20 47·1	19 55·8	20 19·1	20 22·0	No. 1	
„ 11	12 24	13 49	V.G.G.	2	20 18·9	20 53·7	19 53·9	20 11·2	20 19·4	20 19·9	
„ 14	14 50	16 15	V.G.G.	1	20 30·2	20 56·7	19 42·1	20 9·2	20 19·5		
„ 18	12 10	13 33	G.S.J.	1	20 38·3	20 58·7	19 43·5	20 2·2	20 20·7		20 20·4
„ 21	14 32	15 54	G.S.J.	2	20 27·9	20 47·2	19 56·7	20 17·4	20 22·3	No. 2	
„ 25	12 25	13 50	V.G.G.	2	20 16·5	21 6·6	19 40·6	20 17·0	20 20·2	20 21·0	
„ 28	14 50	16 20	V.G.G.	1	20 35·0	21 3·7	19 41·4	20 6·4	20 21·6		
MAR. 3	12 20	13 40	G.S.J.	1	20 36·5	20 56·4	19 47·8	20 2·9	20 20·9		
„ 8	14 36	15 57	G.S.J.	2	20 27·7	20 52·5	19 51·9	20 17·1	20 22·3	No. 1	
„ 11	12 23	13 44	V.G.G.	2	20 24·0	20 56·6	19 49·1	20 17·4	20 21·8	20 21·5	
„ 14	14 50	16 15	V.G.G.	1	20 33·5	21 2·7	19 42·2	20 4·0	20 20·6		20 21·7
„ 18	12 20	13 38	G.S.J.	1	20 37·9	20 59·7	19 49·1	20 2·6	20 22·3		
„ 21	14 50	16 12	G.S.J.	2	20 28·5	20 50·6	19 55·1	20 17·6	20 22·9	No. 2	
„ 25	12 22	13 55	V.G.G.	2	20 19·1	20 57·4	19 50·5	20 16·2	20 20·8	20 21·9	
„ 28	14 55	16 16	V.G.G.	1	20 35·0	21 7·4	19 44·2	20 2·6	20 22·3		
APRIL 1	12 22	13 43	G.S.J.	1	20 35·9	20 56·6	19 48·7	20 7·2	20 22·1		
„ 4	15 18	16 35	V.G.G.	2	20 15·4	20 58·9	19 56·4	20 22·6	20 23·3	No. 1	
„ 8	12 0	13 17	V.G.G.	2	20 29·5	20 53·5	19 44·4	20 19·0	20 21·6	20 23·0	
„ 11	14 48	16 10	V.G.G.	1	20 33·7	21 2·7	19 46·1	20 9·4	20 23·0		
„ 15	12 1	13 18	C.	1	20 36·9	21 3·9	19 44·1	20 8·7	20 23·4		20 22·7
„ 18	14 54	16 5	C.	2	20 29·7	20 55·0	19 50·0	20 18·8	20 23·4	No. 2	
„ 22	12 20	13 40	V.G.G.	2	20 26·4	20 55·7	19 46·0	20 16·0	20 21·0	20 22·3	
„ 25	14 55	16 12	V.G.G.	1	20 36·2	21 9·9	19 35·9	20 11·0	20 23·2		
„ 29	12 1	13 17	C.	1	20 39·9	21 3·1	19 36·0	20 13·5	20 23·1		

1890. Date.	Bombay Civil Time (0 to 24 hours). At commencement.	At conclusion.	Observer.	Needle marked.	End of Needle Dipping. A. Face of Circle. East.	A. Face of Circle. West.	B. Face of Circle. East.	B. Face of Circle. West.	Mean Dip.	Monthly Mean for each Needle.	Monthly Mean.
	h. m.	h. m.			° ′	° ′	° ′	° ′	° ′		° ′
MAY 2	14 52	16 4	C.	2	20 25·4	20 57·2	19 47·7	20 18·5	20 22·2		
„ 6	12 20	13 39	V.G.G.	2	20 27·9	20 54·0	19 41·5	20 16·7	20 20·0	No. 1 ° ′	
„ 9	14 48	16 14	V.G.G.	1	20 40·7	21 12·2	19 30·5	20 7·6	20 22·7	20 23·9	
„ 13	12 22	13 48	G.S.J.	1	20 41·7	20 58·0	19 52·7	20 5·6	20 24·5		
„ 16	14 50	16 10	G.S.J.	2	20 34·9	20 44·0	20 2·0	20 12·1	20 23·2		20 23·1
„ 20	12 20	13 42	V.G.G.	2	20 26·7	20 55·1	19 52·2	20 16·5	20 22·6		
„ 23	14 55	16 25	V.G.G.	1	20 36·6	21 11·1	19 35·2	20 10·1	20 23·2	No. 2 ° ′	
„ 27	12 20	13 39	G.S.J.	1	20 46·5	20 56·1	19 52·9	20 5·7	20 25·3	20 22·4	
„ 30	14 44	16 4	G.S.J.	2	20 33·1	20 51·1	19 59·8	20 12·1	20 24·0		
JUNE 3	12 17	13 45	V.G.G.	2	20 30·2	20 54·5	19 46·7	20 14·9	20 21·6		
„ 6	14 50	16 15	V.G.G.	1	20 44·9	20 53·7	19 49·9	20 4·9	20 23·3	No. 1 ° ′	
„ 10	12 25	13 43	G.S.J.	1	20 37·8	20 53·9	19 53·6	20 7·6	20 23·2	20 23·4	
„ 13	14 35	15 53	G.S.J.	2	20 34·1	20 46·5	20 3·6	20 14·2	20 24·6		
„ 17	12 22	13 48	V.G.G.	2	20 26·5	20 49·6	19 54·7	20 14·0	20 21·2		20 23·3
„ 21	14 55	16 20	V.G.G.	1	20 33·7	21 3·4	19 48·7	20 1·5	20 21·8	No. 2 ° ′	
„ 24	12 20	13 38	G.S.J.	1	20 42·4	20 58·5	19 54·0	20 6·9	20 25·4	20 23·3	
„ 27	14 40	16 3	G.S.J.	2	20 35·4	20 45·3	20 6·0	20 16·2	20 25·7		
JULY 1	12 22	13 44	V.G.G.	2	20 30·6	20 56·9	19 55·4	20 11·7	22 23·6		
„ 4	14 54	16 25	V.G.G.	1	20 38·0	21 2·6	19 46·2	20 5·7	20 23·1	No. 1 ° ′	
„ 8	12 12	13 34	G.S.J.	1	20 39·7	20 54·4	19 53·9	20 7·1	20 23·8	20 23·6	
„ 11	14 38	15 58	G.S.J.	2	20 34·6	20 45·6	20 4·7	20 17·6	20 25·6		
„ 15	12 30	13 53	V.G.G.	2	20 31·2	20 53·1	19 58·6	20 16·2	20 24·8		20 24·4
„ 18	14 50	16 20	V.G.G.	1	20 39·7	21 2·7	19 45·9	20 2·4	20 22·7	No. 2 ° ′	
„ 22	12 12	13 33	G.S.J.	1	20 39·2	20 56·1	19 54·3	20 9·6	20 24·8	20 25·1	
„ 25	14 45	16 3	G.S.J.	2	20 37·4	20 49·4	20 3·5	20 17·3	20 26·9		
„ 29	12 22	13 50	V.G.G.	2	20 25·7	20 47·2	19 57·7	20 27·7	20 24·6		
AUG. 1	14 55	16 29	V.G.G.	1	20 38·7	20 56·5	19 51·9	20 14·7	20 25·4		
„ 5	12 22	13 41	G.S.J.	1	20 40·9	20 57·9	19 53·9	20 9·6	20 25·6	No. 1 ° ′	
„ 8	14 45	16 3	G.S.J.	2	20 32·4	20 45·2	20 4·6	20 15·4	20 24·4	20 25·9	
„ 12	12 27	13 55	V.G.G.	2	20 34·0	20 49·2	20 2·2	20 15·5	20 25·2		
„ 15	14 58	16 18	V.G.G.	1	20 40·7	21 2·5	19 47·2	20 12·2	20 25·6		20 25·7
„ 19	12 10	13 38	G.S.J.	1	20 45·9	21 0·4	19 54·4	20 8·0	20 27·2	No. 2 ° ′	
„ 22	14 51	16 8	G.S.J.	2	20 35·1	20 45·2	20 6·9	20 16·5	20 25·9	20 25·4	
„ 26	12 22	13 43	V.G.G.	2	20 30·4	20 52·7	20 4·1	20 17·2	20 26·1		
„ 29	14 54	16 23	V.G.G.	1	20 38·2	21 1·2	19 52·4	20 10·2	20 25·5		

1890. Date.	Bombay Civil Time (0 to 24 hours). At commencement.	At conclusion.	Observer.	Needle marked.	End of Needle Dipping. A. Face of Circle. East.	A. Face of Circle. West.	B. Face of Circle. East.	B. Face of Circle. West.	Mean Dip.	Monthly Mean for each Needle.	Monthly Mean.
	h. m.	h. m.			° ′	° ′	° ′	° ′	° ′		° ′
SEPT. 2	12 22	13 51	G.S.J.	1	20 33·4	20 55·7	19 51·1	20 10·9	20 22·8		
„ 5	14 36	16 0	G.S.J.	2	20 31·9	20 49·1	20 1·7	20 17·7	20 25·1	No. 1 20 23·6	
„ 9	12 21	13 45	V.G.G.	2	20 30·2	20 49·1	19 57·5	20 17·2	20 23·5		
„ 12	14 53	16 26	V.G.G.	1	20 34·7	20 56·5	19 58·7	20 8·7	20 24·6		
„ 16	12 13	13 36	G.S.J.	1	20 40·2	20 54·5	19 52·9	20 6·0	20 23·4		20 24·0
„ 19	14 45	16 3	G.S.J.	2	20 32·8	20 48·7	20 2·4	20 17·2	20 25·3	No. 2 20 24·4	
„ 23	12 21	13 42	V.G.G.	2	20 34·6	20 44·7	20 1·7	20 13·7	20 23·7		
„ 26	14 52	16 19	V.G.G.	1	20 36·7	20 58·6	19 51·4	20 6·7	20 23·3		
„ 30	12 13	13 37	G.S.J.	1	20 35·9	20 59·8	19 51·4	20 9·5	20 24·1		
OCT. 3	14 43	16 8	G.S.J.	2	20 32·6	20 50·7	20 2·9	20 16·7	20 25·7		
„ 7	12 35	13 55	V.G.G.	2	20 35·7	20 52·4	19 58·4	20 11·4	20 24·5	No. 1 20 24·5	
„ 10	14 50	16 20	V.G.G.	1	20 37·0	21 5·7	19 49·9	20 5·7	20 24·6		
„ 14	12 22	13 43	G.S.J.	1	20 40·1	20 57·7	19 44·6	20 8·2	20 22·6		
„ 17	14 35	15 52	G.S.J.	2	20 34·5	20 48·7	20 3·9	20 16·4	20 25·9		20 25·3
„ 21	12 40	13 55	V.G.G.	2	20 27·5	20 59·0	20 3·5	20 16·1	20 26·5	No. 2 20 25·9	
„ 24	14 53	16 18	V.G.G.	1	20 38·5	21 2·7	19 48·5	20 9·1	20 24·7		
„ 28	12 15	13 34	G.S.J.	1	20 43·1	20 56·9	19 56·7	20 8·2	20 26·2		
„ 31	14 44	16 4	G.S.J.	2	20 36·1	20 51·9	20 2·0	20 16·7	20 26·7		
NOV. 4	12 32	13 58	V.G.G.	2	20 40·9	20 50·9	20 2·7	20 16·5	20 27·7		
„ 7	14 50	16 20	V.G.G.	1	20 48·5	21 0·0	19 53·7	20 4·0	20 26·5	No. 1 20 26·2	
„ 10	12 17	13 39	G.S.J.	1	20 40·7	20 57·1	19 56·1	20 11·2	20 26·3		
„ 14	14 43	16 2	G.S.J.	2	20 38·0	20 46·6	20 3·3	20 24·0	20 28·0		20 26·7
„ 18	12 30	14 2	V.G.G.	2	20 38·5	20 43·0	20 3·5	20 21·5	20 26·6		
„ 21	14 45	16 10	V.G.G.	1	20 45·7	20 57·9	19 57·0	20 4·4	20 26·2	No 2 20 27·2	
„ 25	12 13	13 37	G S.J.	1	20 38·4	20 56·6	19 55·9	20 12·5	20 25·8		
„ 28	14 45	16 4	G.S.J.	2	20 34·8	20 46·7	20 6·2	20 18·9	20 26·6		
DEC. 2	12 23	13 50	V.G.G.	2	20 35·7	20 49·9	19 59·2	20 17·7	20 25·6		
„ 5	14 50	16 18	V.G.G.	1	20 42·0	21 0·5	19 52·2	20 7·5	20 25·5	No. 1 20 26·3	
„ 9	12 13	13 42	G.S.J.	1	20 40·8	20 58·0	19 57·1	20 11·6	20 26·9		
„ 12	14 40	16 1	G.S.J.	2	20 32·2	20 47·1	20 5·7	20 20·6	20 26·4		
„ 16	12 22	13 45	V.G.G.	2	20 31·2	20 52·9	20 4·1	20 21·7	20 27·5		20 26·5
„ 19	14 55	16 25	V.G.G.	1	20 39·9	21 2·5	19 53·6	20 7·2	20 25·8	No. 2 20 26·7	
„ 23	12 16	13 41	G.S.J.	1	20 42·1	20 59·2	19 54·4	20 12·2	20 27·0		
„ 26	14 45	16 3	V.G.G.	2	20 29·5	20 55·4	19 59·7	20 21·2	20 26·4		
„ 30	12 5	13 22	V.G.G.	2	20 34·6	20 51·2	19 59·2	20 25·5	20 27·6		

The Mean Dip for the year ... { With Needle No. 1 = 20 23·5 ; With Needle No. 2 = 20 23·9 }

The Mean Dip for the year 1890 = 20 23·7

Absolute Magnetical Observations.—Table III *a*.

SUPPLEMENTARY OBSERVATIONS OF INCLINATION, 1890.

Taken with Barrow's Dip Circle, with Microscopes, No. 49 and two 3½-inch Needles, Nos. $\frac{1}{81}$ and $\frac{2}{81}$, by John Dover.

1890. Date.	Bombay Civil Time (0 to 24 hours). At commencement.	At conclusion.	Observer.	Needle marked.	End of Needle Dipping. A. Face of Circle. East.	A. Face of Circle. West.	B. Face of Circle. East.	B. Face of Circle. West.	Mean Dip.	Monthly Mean for each Needle.	Monthly Mean.
	h. m.	h. m.			° ′	° ′	° ′	° ′	° ′		° ′
JAN. 3	14 6	17 12	V.G.G.	$\frac{1}{81}$	20 4·7	20 35·5	20 14·6	20 33·4	20 22·0		
„ 7	11 30	14 42	G.S.J.	$\frac{1}{81}$	20 6·5	20 30·6	20 13·9	20 39·8	20 22·7	No. $\frac{1}{81}$	
„ 10	13 49	17 0	G.S.J.	$\frac{2}{81}$	20 1·8	20 17·7	20 6·4	20 43·9	20 17·4	° ′ 20 20·8	
„ 14	11 31	14 43	V.G.G.	$\frac{2}{81}$	19 51·1	20 16·2	20 10·7	20 56·9	20 18·7		
„ 17	14 2	17 25	V.G.G.	$\frac{1}{81}$	20 3·1	20 35·4	20 14·2	20 31·4	20 21·0		20 19·7
„ 21	11 30	14 38	G.S.J.	$\frac{1}{81}$	20 5·2	20 26·6	20 15·4	20 32·1	20 19·8	No. $\frac{2}{81}$	
„ 24	13 42	16 57	G.S.J.	$\frac{2}{81}$	20 4·4	20 20·7	20 5·1	20 45·1	20 18·8	° ′ 20 18·4	
„ 28	11 30	14 35	V.G.G.	$\frac{2}{81}$	19 46·7	20 30·5	20 8·0	20 49·9	20 18·8		
„ 31	14 13	17 15	V.G.G.	$\frac{1}{81}$	20 0·1	20 27·2	20 14·5	20 31·4	20 18·3		
FEB. 4	11 30	14 46	G.S.J.	$\frac{1}{81}$	20 5·1	20 24·3	20 13·1	20 35·7	20 19·5		
„ 7	13 45	16 59	G.S.J.	$\frac{2}{81}$	20 3·6	10 20·3	20 9·0	20 55·3	20 22·0	No. $\frac{1}{81}$	
„ 11	11 29	14 49	V.G.G.	$\frac{2}{81}$	19 45·7	20 20·5	20 14·0	20 57·7	20 19·5	° ′ 20 19·3	
„ 14	14 0	17 8	V.G.G.	$\frac{1}{81}$	20 0·7	20 33·0	20 5·0	20 40·2	20 19·7		20 19·3
„ 18	11 29	14 33	G.S.J.	$\frac{1}{81}$	20 4·4	20 22·9	20 13·1	20 38·2	20 19·6		
„ 21	13 43	16 50	G.S.J.	$\frac{2}{81}$	19 52·2	20 5·0	20 26·4	20 47·3	20 17·7	No. $\frac{2}{81}$	
„ 25	11 35	14 40	V.G.G.	$\frac{2}{81}$	19 47·0	20 14·2	20 17·1	20 52·9	20 17·8	° ′ 20 19·2	
„ 28	13 55	17 10	V.G.G.	$\frac{1}{81}$	20 0·0	20 29·1	20 9·0	20 35·2	20 18·3		
MAR. 3	11 26	14 38	G.S.J.	$\frac{1}{81}$	20 5·4	20 27·5	20 16·6	20 36·4	20 21·5		
„ 8	13 44	17 2	G.S.J.	$\frac{2}{81}$	19 43·7	20 4·8	20 26·9	20 54·5	20 17·5	No. $\frac{1}{81}$	
„ 11	11 30	14 42	V.G.G.	$\frac{2}{81}$	19 42·0	20 22·1	20 16·4	20 56·0	20 19·1	° ′ 20 21·0	
„ 14	14 0	17 10	V.G.G.	$\frac{1}{81}$	20 4·1	20 36·0	20 10·5	20 32·5	20 20·8		20 20·1
„ 18	11 25	14 33	G.S.J.	$\frac{1}{81}$	20 5·4	20 28·9	20 11·4	20 36·9	20 20·6		
„ 21	13 55	17 5	G.S.J.	$\frac{2}{81}$	20 4·9	20 26·2	20 5·6	20 47·4	20 21·0	No. $\frac{2}{81}$	
„ 25	11 31	14 40	V.G.G.	$\frac{2}{81}$	19 47·2	20 29·4	20 5·4	20 55·9	20 19·5	° ′ 20 19·3	
„ 28	14 0	17 1	V.G.G.	$\frac{1}{81}$	20 9·9	20 27·1	20 12·4	20 34·5	20 21·0		
APRIL 1	11 30	14 38	G.S.J.	$\frac{1}{81}$	20 5·9	20 33·0	20 14·7	20 33·6	20 21·8		
„ 4	14 30	17 25	V.G.G.	$\frac{2}{81}$	19 48·7	20 25·0	20 10·9	20 57·7	20 20·6	No. $\frac{1}{81}$	
„ 8	11 15	14 15	V.G.G.	$\frac{2}{81}$	20 0·2	20 21·2	20 4·0	20 56·4	20 20·4	° ′ 20 21·7	
„ 11	14 0	17 5	V.G.G.	$\frac{1}{81}$	20 6·5	20 35·0	20 10·5	20 36·7	20 22·2		
„ 15	11 17	14 11	C.	$\frac{1}{81}$	20 6·5	20 31·9	20 13·2	20 38·2	20 22·4		20 21·1
„ 18	14 10	16 54	C.	$\frac{2}{81}$	19 59·7	20 25·1	20 12·6	20 48·7	20 21·5	No. $\frac{2}{81}$	
„ 22	11 25	14 32	V.G.G.	$\frac{2}{81}$	19 55·6	20 21·6	20 4·5	20 56·4	20 19·5	° ′ 20 20·5	
„ 25	14 1	17 5	V.G.G.	$\frac{1}{81}$	20 8·0	20 24·4	20 8·2	20 39·7	20 20·1		
„ 29	11 15	14 8	C.	$\frac{1}{81}$	20 7·2	20 31·7	20 10·7	20 37·5	20 21·8		

1890. Date.	Bombay Civil Time (0 to 24 hours). At commencement.		At conclusion.		Observer.	Needle marked.	End of Needle Dipping. A. Face of Circle. East.		End of Needle Dipping. A. Face of Circle. West.		End of Needle Dipping. B. Face of Circle. East.		End of Needle Dipping. B. Face of Circle. West.		Mean Dip.	Monthly Mean for each Needle.	Monthly Mean.
	h.	m.	h.	m.			°	′	°	′	°	′	°	′	°	′	
MAY 2	14	5	16	52	C.	2/81	19	59·7	20	31·2	20	5·9	20	51·6	20	22·1	
„ 6	11	30	14	33	V.G.G.	2/81	20	6·7	20	27·7	19	58·2	20	46·4	20	19·7	No. 1/81
„ 9	14	0	17	12	V.G.G.	1/81	20	3·1	20	37·6	20	9·6	20	33·5	20	20·9	20 22·0
„ 13	11	28	14	36	G.S.J.	1/81	20	7·3	20	25·6	20	23·7	20	36·9	20	23·4	
„ 16	13	56	17	11	G.S.J.	2/81	20	30·1	20	35·0	19	54·9	20	21·1	20	20·3	20 21·3
„ 20	11	26	14	32	V.G.G.	2/81	20	19·2	20	31·7	20	6·6	20	24·5	20	20·5	No. 2/81
„ 23	14	2	17	16	V.G.G.	1/81	19	59·5	20	27·2	20	22·4	20	35·5	20	21·1	20 20·7
„ 27	11	27	14	42	G.S.J.	1/81	20	13·6	20	33·8	20	15·1	20	28·7	20	22·8	
„ 30	13	50	17	3	G.S.J.	2/81	20	21·5	20	26·2	19	56·7	20	39·6	20	21·0	
JUNE 3	11	28	14	32	V.G.G.	2/81	20	4·9	20	33·0	19	55·0	20	41·7	20	18·6	
„ 6	13	56	17	6	V.G.G.	1/81	20	11·0	20	37·5	20	9·4	20	27·0	20	21·2	No. 1/81
„ 10	11	28	14	35	G.S.J.	1/81	20	16·2	20	32·4	20	10·1	20	31·5	20	22·5	20 22·4
„ 13	13	41	16	55	G.S.J.	2/81	20	16·9	20	24·6	20	4·1	20	19·7	20	16·3	20 20·2
„ 17	11	32	14	40	V.G.G.	2/81	20	21·9	20	32·7	19	58·0	20	17·7	20	17·6	
„ 21	14	0	17	15	V.G.G.	1/81	20	14·5	20	36·2	20	6·4	20	27·5	20	21·1	No. 2/81
„ 24	11	28	14	41	G.S.J.	1/81	20	16·6	20	32·0	20	10·0	20	40·9	20	24·9	20 17·9
„ 27	13	48	17	0	G.S.J.	2/81	20	30·7	20	35·5	19	52·2	20	18·6	20	19·2	
JULY 1	11	33	14	40	V.G.G.	2/81	20	22·5	20	35·4	19	53·0	20	21·0	20	18·0	
„ 4	14	4	17	22	V.G.G.	1/81	20	11·4	20	34·9	20	7·0	20	37·7	20	22·7	No. 1/81
„ 8	11	22	14	34	G.S.J.	1/81	20	15·4	20	34·5	20	16·2	20	30·9	20	24·2	20 23·2
„ 11	13	45	16	59	G.S.J.	2/81	20	23·4	20	31·9	20	0·2	21	26·3	20	20·4	
„ 15	11	29	14	40	V.G.G.	2/81	20	16·7	20	31·4	20	5·7	20	29·7	20	20·9	20 21·6
„ 18	14	1	17	15	V.G.G.	1/81	20	14·0	20	35·4	20	8·5	20	29·0	20	21·7	No. 2/81
„ 22	11	20	14	31	G.S.J.	1/81	20	17·5	20	32·4	20	16·4	20	30·5	20	24·2	20 20·4
„ 25	13	51	17	0	G.S.J.	2/81	20	28·2	20	34·0	20	1·3	20	24·3	20	21·9	
„ 29	11	35	14	36	V.G.G.	2/81	20	18·2	20	31·4	20	7·1	20	25·7	20	20·6	
AUG. 1	14	0	17	17	V.G.G.	1/81	20	12·7	20	35·4	20	16·2	20	30·5	20	23·7	
„ 5	11	30	14	40	G.S.J.	1/81	20	18·4	20	32·4	20	16·0	20	38·1	20	26·2	No. 1/81
„ 8	13	52	16	59	G.S.J.	2/81	20	26·5	20	30·2	20	0·0	20	26·8	20	20·9	20 26·3
„ 12	11	28	14	50	V.G.G.	2/81	20	18·2	20	27·9	19	54·2	20	34·5	20	18·7	
„ 15	14	5	17	10	V.G.G.	1/81	20	19·9	20	38·4	20	16·0	20	33·1	20	26·8	20 23·6
„ 19	11	18	14	35	G.S.J.	1/81	20	16·4	20	34·5	20	16·6	20	46·6	20	28·5	No. 2/81
„ 22	13	58	17	4	G.S.J.	2/81	20	29·4	20	30·4	19	58·9	20	25·9	20	21·1	20 20·2
„ 26	11	30	14	38	V.G.G.	2/81	20	18·0	20	32·5	20	3·0	20	27·6	20	20·3	
„ 29	14	2	17	15	V.G.G.	1/81	20	13·1	20	35·7	20	15·9	20	40·0	20	26·2	

1890. Date.	Bombay Civil Time (0 to 24 hours). At commencement.	At conclusion.	Observer.	Needle marked.	End of Needle Dipping. A. Face of Circle. East.	A. Face of Circle. West.	B. Face of Circle. East.	B. Face of Circle. West.	Mean Dip.	Monthly Mean for each Needle.	Monthly Mean.
	h. m.	h. m.			° ′	° ′	° ′	° ′	° ′		° ′
SEPT. 2	11 27	14 39	G.S.J.	1/81	20 12·7	20 29·2	20 8·0	20 47·9	20 24·4		
,, 5	13 45	16 58	G.S.J.	2/81	20 19·4	20 35·6	19 53·6	20 27·2	20 18·9	No. 1/81	
,, 9	11 31	14 35	V.G.G.	2/81	20 22·5	20 36·0	19 57·4	20 24·5	20 20·1	° ′ 20 26·7	
,, 12	14 0	17 20	V.G.G.	1/81	20 17·0	20 28·0	20 12·0	20 45·5	20 25·6		
,, 16	11 21	14 32	G.S.J.	1/81	20 25·4	20 25·4	20 22·3	20 45·0	20 29·5		20 23·6
,, 19	13 51	17 2	G.S.J.	2/81	20 33·4	20 34·0	20 3·0	20 12·7	20 20·8	No. 2/81	
,, 23	11 30	14 35	V.G.G.	2/81	20 23·7	20 32·6	20 8·5	20 12·6	20 19·3	° ′ 20 19·8	
,, 26	14 0	17 15	V.G.G.	1/81	20 19·5	20 29·0	20 17·5	20 38·0	20 26·0		
,, 30	11 20	14 33	G.S.J.	1/81	20 18·1	20 29·2	20 17·2	20 47·0	20 27·9		
OCT. 3	13 50	17 10	G.S.J.	2/81	20 33·7	20 35·1	20 1·4	20 20·6	20 22·7		
,, 7	11 40	14 45	V.G.G.	2/81	20 19·7	20 36·7	20 1·4	20 28·9	20 21·7	No. 1/81	
,, 10	14 0	17 17	V.G.G.	1/81	20 20·1	20 35·1	20 14·9	20 36·9	20 26·7	° ′ 20 27·6	
,, 14	11 29	14 44	G.S.J.	1/81	20 32·1	20 28·5	20 21·5	20 34·9	20 29·2		
,, 17	13 43	16 54	G.S.J.	2/81	20 32·9	20 28·7	19 54·1	20 23·1	20 19·7		20 24·5
,, 21	11 50	14 48	V.G.G.	2/81	20 20·4	20 31·9	20 2·7	20 26·9	20 20·5	No. 2/81	
,, 24	14 7	17 13	V.G.G.	1/81	20 22·1	20 33·7	20 21·0	20 33·6	20 27·6	° ′ 20 21·9	
,, 28	11 20	14 31	G.S.J.	1/81	20 25·4	20 32·0	20 22·0	20 29·0	20 27·1		
,, 31	13 50	17 2	G.S.J.	2/81	20 29·0	20 31·9	20 2·6	20 36·0	20 24·9		
NOV. 4	11 40	14 45	V.G.G.	2/81	20 25·5	20 33·6	20 5·2	20 41·2	20 26·4		
,, 7	14 0	17 15	V.G.G.	1/81	20 18·4	20 34·4	20 22·7	20 32·5	20 27·0	No. 1/81	
,, 10	11 22	14 35	G.S.J.	1/81	20 23·7	20 29·8	20 27·5	20 30·0	20 27·7	° ′ 20 28·3	
,, 14	13 46	16 59	G.S.J.	2/81	20 32·4	20 39·5	19 59·6	20 22·8	20 23·6		
,, 18	11 30	14 47	V.G.G.	2/81	20 32·7	20 33·9	20 0·5	20 21·9	20 22·2		20 26·0
,, 21	13 50	17 5	V.G.G.	1/81	20 24·1	20 27·0	20 29·0	20 36·4	20 29·1	No. 2/81	
,, 25	11 20	14 34	G.S.J.	1/81	20 27·6	20 29·5	20 22·6	20 37·6	20 29·3	° ′ 20 23·7	
,, 28	13 52	17 1	G.S.J.	2/81	20 29·7	20 29·9	20 1·3	20 29·9	20 22·7		
DEC. 2	11 32	14 40	V.G.G.	2/81	20 31·5	20 31·5	19 59·4	20 26·0	20 22·1		
,, 5	13 55	17 10	V.G.G.	1/81	20 21·5	20 35·9	20 12·7	20 42·9	20 28·2	No. 1/81	
,, 9	11 20	14 37	G.S.J.	1/81	20 18·7	20 36·3	20 18·1	20 34·9	20 27·0	° ′ 20 26·9	
,, 12	13 48	17 0	G.S.J.	2/81	20 23·7	20 34·9	19 55·2	20 26·7	20 20·1		
,, 16	11 35	14 42	V.G.G.	2/81	20 13·5	20 34·7	20 2·0	20 33·9	20 21·0		20 23·9
,, 19	14 0	17 17	V.G.G.	1/81	20 15·6	20 33·2	20 18·2	20 35·9	20 25·7	No. 2/81	
,, 23	11 23	14 35	G.S.J.	1/81	20 19·9	20 35·5	20 17·9	20 34·0	20 26·8	° ′ 20 21·6	
,, 26	14 0	17 0	V.G.G.	2/81	20 21·0	20 39·0	20 2·5	20 25·9	20 22·1		
,, 30	11 15	14 15	V.G.G.	2/81	20 26·5	20 38·5	20 1·2	20 23·9	20 22·5		

The Mean Dip for the year... { With Needle No. 1/81 = 20 23·8 ; With Needle No. 2/81 = 20 20·3 }

The Mean Dip for the year 1890 = 20 22·1

BOMBAY

MAGNETICAL AND METEOROLOGICAL OBSERVATIONS,

1890.

Appendix.

THE ABSOLUTE MAGNETIC DECLINATION AND HORIZONTAL FORCE AT BOMBAY AND THEIR SECULAR AND ANNUAL VARIATIONS.

By

CHARLES CHAMBERS, F.R.S.,

DIRECTOR OF THE COLA'BA OBSERVATORY, BOMBAY.

B 1210—AP—a

The Absolute Magnetic Declination and Horizontal Force at Bombay, and their secular and annual variations.

By Charles Chambers, F. R. S., Director of the Colaba Observatory.*

1210—1 a*

The observations discussed in this paper were taken at the Colába Observatory during the years 1867 to 1890, and consist of observations of absolute declination, and of vibration of a collimator magnet and of deflection by it of a suspended magnet. The instrument with which they were taken is a Unifilar Magnetometer by Elliott Brothers, and was examined and approved at the Kew Oservatory before being sent out to India in the year 1867. Complete observations were taken regularly, of declination once a week, and of vibration and deflection twice a week, on a plan which will be found described in detail in the Introduction to the Bombay Magnetical and Meteorological Observations, 1865—70, pages xxxiii to liii.

2. *Data for present investigation.*—These consist of the monthly means of the determinations of declination and of the monthly means of the values, deduced from the observations of vibration and deflection, of the horizontal force.

I.—DECLINATION.

3. *Monthly mean values.*—In Table I are collected the monthly means of the values of absolute declination as observed from July 1867 to December 1890, and the corresponding mean readings of Grubb's declination magnetometer†; and in Table II are shown the same mean values of declination, corrected for the difference between the corresponding mean readings of Grubb's declination magnetometer and the mean readings of that instrument (also given with the same Table) for the respective months, the corrected values thus obtained showing the mean declination of the several months. The adopted value of a unit of the scale of Grubb's declination magnetometer is 6′ 49″·5, increasing readings denoting increase of easterly declination :—

[1]

TABLE I.

Year.	Mean observed Easterly Declination.												Corresponding mean Scale-reading of Grubb's Declination Magnetometer.											
	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″												
1867... ...	...	...	..	...	...	...	41 34	41 15	41 20	42 18	43 38	43 58	...	...	...	...	...	...	34·86	34·80	34·78	34·92	35·08	35·19
1868... ...	44 16	44 2	44 56	43 19	42 27	42 24	43 24	43 39	42 31	44 51	46 4	45 34	35·25	35·30	35·32	35·12	35·12	35·07	35·25	35·21	35·14	35·47	35·59	35·44
1869... ...	46 15	46 56	46 22	45 7	45 26	45 38	45 37	45 16	45 15	46 29	47 13	47 43	35·55	35·54	35·46	35·28	35·38	35·38	35·47	35·38	35·46	35·62	35·73	35·74
1870	47 9	47 4	48 4	46 36	47 0	46 54	47 17	46 43	47 23	49 15	49 47	50 7	35·70	35·73	35·88	35·64	35·67	35·63	35·66	35·02	35·70	36·02	36·17	36·21
1871... ...	49 7	50 18	49 32	48 31	49 11	48 37	48 48	49 10	48 50	50 6	51 31	51 52	36·13	36·26	36·13	35·94	36·01	35·92	35·95	35·97	35·97	36·10	36·31	36·33
1872... ...	53 11	52 43	50 57	50 45	50 29	51 6	50 6	51 6	50 8	52 46	52 35	52 58	36·59	36·53	36·23	36·20	36·17	36·24	36·09	36·21	36·06	36·47	36·44	36·46
1873... ...	53 6	53 2	52 35	53 14	52 0	52 20	52 52	51 15	51 49	52 46	52 59	53 30	36·50	36·50	36·47	36·53	36·30	36 36	36·41	36·16	36·30	36·47	36·51	36·60
1874... ...	53 17	54 36	54 8	52 16	52 33	53 26	53 30	52 50	52 37	53 49	53 38	54 27	36·64	36·81	36·72	36·42	36·43	36·52	36·55	36·46	36·43	36·59	36·57	36·66
1875... ...	54 3	54 13	55 41	54 53	53 52	54 8	54 35	53 57	53 11	53 55	54 51	55 53	36·62	36·66	36·88	36·77	36·59	36·64	36·71	36·67	36·53	36·66	36·77	36·80
1876... ...	56 4	55 36	55 30	54 44	53 34	53 33	54 28	54 51	55 0	54 52	55 42	56 37	36·94	36·87	36·86	36 77	36·61	36·60	36·70	36·72	36·72	36·68	36·82	36·98
1877... ...	56 21	55 57	56 22	55 23	55 11	54 52	55 32	54 23	54 23	55 34	56 6	56 24	36·91	36·89	36·93	36·80	36·76	35·71	36·82	36·62	36·59	36·70	36·86	36·88
1878... ...	56 56	56 32	56 21	55 59	55 31	55 53	56 0	55 22	55 21	55 8	56 31	56 31	36·95	36·86	36·86	36·82	36·74	36·70	36 87	36·81	36·78	36·75	36·95	36·91
1879... ...	56 58	57 20	57 29	56 41	55 48	56 21	55 44	55 45	56 21	55 52	55 50	56 59	36·91	36·98	37 00	36·90	36·75	36·84	36·75	36·76	36·88	36·83	36·81	36·97
1880... ...	57 25	57 23	57 26	56 14	55 25	55 30	56 0	55 5	55 50	56 15	56 50	56 47	37·05	37·07	37·10	36 90	36·74	36·73	36·81	36·65	36·80	36·87	36·95	36·99
1881... ...	56 10	57 8	57 9	55 33	54 51	54 59	55 51	54 36	55 18	56 3	56 43	56 40	36·94	37·07	37·07	36·82	36·71	36·72	36·79	36·65	36·77	36·86	36·95	36·88
1882... ...	56 29	56 50	55 42	56 6	54 41	55 6	55 11	54 38	55 27	56 15	56 52	57 39	36·85	36·92	36·73	36 77	36·53	36·55	36·55	36·48	36·60	36·77	36·90	37·02
1883... ...	56 54	57 32	57 1	55 32	55 12	55 56	56 28	56 7	54 29	55 8	55 46	54 55	36·90	36·97	36·91	36·67	36·63	36·71	36·80	36·91	36·69	36·82	36·90	36·90
1884... ...	55 33	56 24	55 21	54 8	53 37	53 26	54 32	52 42	53 44	54 53	54 14	56 0	36·90	36·98	36·78	36·58	36·53	36·42	36·65	36·37	36·52	36·70	36·61	36·81
1885... ...	55 43	54 32	55 8	54 2	53 6	53 44	53 32	52 3	52 21	54 0	53 46	54 25	36·82	36 68	36·72	36·5	36·33	36·35	36·38	36·16	36·20	36·52	36·47	36·56
1886... ...	54 0	54 5	53 57	52 25	51 6	52 20	52 49	51 25	51 13	52 8	52 28	52 56	36·58	36·64	36·62	36·40	36·19	36·31	36·36	36·14	36·12	36·27	36·32	36·40
1887... ...	52 30	53 1	53 3	51 0	50 39	50 38	50 18	49 56	49 56	50 32	51 9	51 49	36·32	36·38	36·36	36·08	36·05	36·00	35·96	35·91	35·90	36·02	36·09	36·23
1888... ...	51 1	51 4	51 27	50 16	49 56	50 0	49 15	49 10	48 53	49 59	50 5	49 42	36·14	36·09	36·11	35·94	35·95	36·00	35·85	35·81	35·84	35·99	36·04	36·00
1889	49 35	49 1	49 38	47 57	47 39	48 10	48 6	47 36	46 54	48 1	47 50	48 14	35·96	35·88	35·95	35 60	35·61	35·68	35·66	35·58	35·46	35·60	35·61	35·72
1890... ...	47 48	48 35	47 29	46 47	46 9	45 34	45 5	45 16	44 34	45 49	46 18	47 4	35·67	35·78	35·60	35·50	35·40	35·3.	35·24	35·25	35·17	35·37	35·44	35·50

* Being parts of a paper entitled "The Absolute Direction and Intensity of the Earth's Magnetic Force at Bombay," published in the "Philosophical Transactions, 1876," re-written and extended so as to embrace observations made up to 1890.

† The similar values and scale readings for individual observations, of which these are the monthly means, are printed in the several volumes of "Bombay Magnetical and Meteorological Observations" from 1865—70 to 1890.

Table II.

	Mean monthly declination reduced to mean monthly reading of Grubb's Declination Magnetometer.												Mean monthly reading of Grubb's Declination Magnetometer.											
	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″												
1867... ...	...	...	...	...	...	...	43 16	43 6	43 35	43 56	44 19	43 58	...	...	...	...	...	...	35·11	35·07	35·11	35·16	35·18	35·19
1868... ...	44 8	43 54	44 52	45 14	44 26	44 43	44 38	45 38	45 31	46 1	45 56	45 42	35·23	35·28	35·31	35·40	35·41	35·41	35·43	35·50	35·58	35·64	35·57	35·46
1869... ...	45 55	47 0	47 15	47 30	47 37	47 49	47 23	47 47	47 38	47 47	47 50	48 20	35·50	35·55	35·59	35·63	35·70	35·70	35·68	35·75	35 81	35·81	35·82	35·83
1870... ...	48 27	48 14	48 33	48 55	48 51	48 57	49 16	49 39	50 35	50 37	50 7	50 8	35·89	35·90	35·95	35·98	35·94	35·93	35·95	36·05	36·17	36·22	36·22	36·21
1871... ...	49 52	50 26	50 46	51 3	50 53	50 44	51 3	51 37	51 22	52 1	52 28	52 21	36·24	36·28	36·31	36·31	36·26	36·23	36·28	36·33	36·34	36·38	36·45	36·44
1872... ...	52 26	52 43	52 52	52 52	52 40	52 48	52 38	53 13	53 12	53 43	53 45	53 47	36·48	36·53	36·51	36·51	36·49	36·49	36·46	36·52	36·51	36·61	36·61	36·60
1873... ...	53 51	53 43	53 49	53 55	53 51	54 2	54 14	54 36	54 12	54 0	53 56	53 48	36·61	36·60	36·65	36·63	36·57	36·61	36·61	36·65	36·65	36·65	36·65	36·67
1874... ...	53 37	53 59	54 8	54 19	54 19	54 40	54 31	54 32	54 23	54 55	54 52	55 4	36 69	36·72	36·72	36·72	36·69	36·70	36·70	36·71	36·69	36·75	36·75	36·78
1875... ...	55 0	55 6	55 21	55 22	55 38	55 14	55 24	55 27	55 14	55 9	55 28	55 49	36·76	36·79	36·83	36·84	36·85	36·80	36·83	36·85	36·83	36·84	36·86	36·88
1876... ...	55 48	55 56	55 50	55 37	55 33	55 32	55 46	56 9	56 22	56 22	56 19	56 25	36·90	36·92	36·91	36·90	36·90	36·89	36·89	36·91	36·92	36·90	36·91	36·95
1877... ...	56 37	56 17	56 42	56 37	56 41	56 30	56 21	56 34	56 46	56 52	56 51	57 1	36·95	36·94	36·98	36·98	36·98	36·95	36·94	36·94	36·94	36·95	36·97	36·96
1878... ...	57 0	57 21	57 10	57 13	56 57	57 7	57 1	56 40	56 51	57 7	57 20	57 28	36·96	36·98	36·98	37·00	36·95	36·94	37·02	37·00	37·00	37·04	37·07	37·05
1879... ...	57 35	57 32	57 33	57 26	57 30	57 35	57 51	57 40	57 51	57 6	57 8	57 15	37·00	37·01	37·01	37·01	37·00	37·02	37·06	37·07	37·10	37·01	37·00	37·01
1880... ...	57 9	57 3	56 53	56 55	56 59	57 4	57 14	57 28	57 12	57 8	57 23	57 20	37·01	37·02	37·02	37·00	36·97	36·96	36·99	37·02	37·00	37·00	37·03	37·07
1881... ...	56 59	57 24	57 1	57 24	57 43	57 10	57 21	57 12	56 56	57 9	57 28	56 32	37·06	37·11	37·09	37·09	37·13	37·04	37·01	37·01	37·01	37·02	37·06	36·86
1882... ...	56 29	56 21	56 31	56 51	56 40	56 44	56 49	56 33	56 45	57 21	57 37	57 19	36·85	36·85	36·85	36·88	36·82	36·81	36·79	36·76	36·79	36·93	37·01	36·97
1883... ...	57 6	57 28	57 30	57 43	57 3	57 38	57 34	57 0	57 1	56 30	56 11	55 44	36·93	36·96	36·98	36·99	36·90	36·96	36·96	37·04	37·06	37·02	37·05	37·02
1884... ...	55 33	55 47	56 6	56 7	55 44	55 45	55 46	55 34	55 22	55 30	55 24	55 11	36·90	36·89	36·89	36·87	36·84	36·82	36·83	36·79	36·76	36·79	36·78	36·75
1885... ...	55 18	55 17	55 8	55 20	55 29	55 22	55 10	55 15	55 1	54 26	54 31	54 25	36·76	36·76	36·72	36·70	36·68	36·63	36·62	36·63	36·59	36·57	36·58	36·59
1886... ...	54 16	53 49	53 37	53 35	53 21	53 26	53 38	53 36	53 4	53 5	53 9	53 4	36·62	36·60	36·57	36·57	36·52	36·47	36·48	36·46	36·39	36·41	36·42	36·42
1887... ...	52 59	53 9	52 59	52 42	52 21	52 24	52 13	52 11	52 11	51 42	51 54	51 33	36·39	36·40	36·38	36·33	36·30	36·26	36·24	36·24	36·23	36·19	36·20	36·19
1888... ...	51 13	51 45	51 47	52 15	51 59	51 22	51 30	51 25	51 8	51 5	50 58	50 2	36·17	36·19	36·16	36·23	36·25	36·20	36·18	36·18	36·17	36·15	36·17	36·05
1889... ...	50 0	49 46	49 54	49 52	49 38	49 24	49 28	49 22	49 13	49 19	49 12	48 39	36·02	35·99	35·99	35·94	35·90	35·86	35·86	35·84	35·80	35·79	35·81	35·78
1890... ...	48 29	48 19	48 10	47 53	47 51	47 29	47 24	47 27	47 10	46 59	46 55	46 44	35·77	35·74	35·70	35·66	31·65	35·61	35·58	35·57	35·55	35·54	35·53	35·51

The mean scale-readings in Table II. up to the end of 1872 are derived from 24 hourly observations of the magnetometer taken each day except on Sundays and holidays, whilst those from 1873 to 1890 are derived from 5 observations taken daily at each of the hours 6, 10, 14, 16 and 22; but the latter are reduced to the 24-hours' mean of the several months by subtracting the following numbers respectively, *viz.*: +·016, +·008, +·009, —·013, —·013, —·016, —·017, —·018, —·004, +·005, +·003, and +·011; these numbers being the means of the hourly inequalities at the five hours for the period 1846 to 1872. It is of little consequence whether these corrections are made or not, as the greatest of them is equivalent only to 8 seconds of arc and the mean of the twelve to 1 second only, but they have in fact been applied.

4. In Table III. are collected together the monthly mean tabulations (in inches) of the curves of the declination magnetograph at times corresponding to those of the absolute declination observations, and also the mean monthly tabulations, for the 24 hours of each day, of the same curves:—

TABLE III.

Year.	Declination Magnetograph.											
	Mean tabulation at times of Absolute Declination Observations.											
	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1871 .	3·126	3·084	3·114	3·155	3·107	3·085	3·083	3·083	3·082	3·053	3·009	3·004
1872 ...	2·968	2·974	·031	·054	·069	·041	·061	·031	·078	2·983	.000	2·984
1873 ...	·992	·986	2·993	2·967	·024	·005	2·994	·057	·014	·980	2·974	·950
1874 ...	·956	·917	·938	·997	2·990	2·967	·957	2·974	2·985	·947	·963	·940
1875 ...	·960	·956	·895	·927	·971	·950	·926	·948	·957	·939	·911	·889
1876 ...	·884	·892	·887	·908	·944	a	b	·896	·902	·906	·873	·844
1877 ...	·858	·865	·852	·882	·885	·888	·857	·902	·908	·870	·851	·847
1878 ...	·837	·856	·851	·865	·867	·855	·848	·857	·865	·876	·837	·857
1879	·842	·829	·819	·839	·873	·857	·889	·880	·870	·861	·864	·830
1880 ..	·816	·814	·797	·852	·868	·871	·856	·894	·861	·837	·835	·842
1881 ...	·864	·829	·824	·885	·921	·907	·867	·917	·886	·869	·853	·834
1882 ...	·845	·828	·871	·863	·899	·886	e	·899	·883	·863	·848	·823
1883 .	·851	·843	·852	·904	·908	·911	·881	·881	·930	·908	·869	·902
1884 ...	·875	·857	·891	·931	·940	·949	·906	·967	·939	·901	·931	·875
1885 ...	·888	·930	·904	·949	·985	·965	·970	3·020	3·010	·936	·956	·937
1886 ...	·950	·939	·940	·982	3·021	·993	·982	·033	·037	3·002	3·001	·992
1887 ...	3·011	3·005	·996	3·061	·064	3·071	3·078	·089	·088	·062	·054	d
1888 ..	·050	·061	3·053	·109	·115	·098	·128	·128	·131	·101	·093	3·095

Year.	Mean monthly tabulation of the Declination Magnetograph—derived from hourly tabulations.											
	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1871 .	3·098	3·085	3·078	3·068	3·043	3·015	3·009	3·001	2·998	2·986	2·973	2·984
1872 ...	2·989	2·976	2·964	2·969	2·998	2·985	2·974	2·962	·968	·951	·960	·962
1873 ...	·964	·963	·950	·948	·953	·947	·941	·940	·934	·939	·940	·942
1874 ...	·942	·935	·932	·927	·931	·927	·924	·920	·921	·912	·921	·918
1875 ...	·930	·922	·904	·906	·907	·905	·899	·900	·893	·892	·890	·890
1876 ...	·890	·885	·877	·881	·877	·868	·859	·853	·849	·849	·852	·847
1877 ...	·847	·852	·844	·846	·841	·842	·833	·831	·828	826	·822	·825
1878 ...	·829	·826	·828	·823	·818	·820	·826	·829	·827	·819	·815	·815
1879	·819	·819	·815	·818	·825	·825	·828	·832	·818	·816	·821	·825
1880 ..	·832	·830	·812	·822	·812	·813	·812	·810	·809	·806	·810	·819
1881 ...	·826	·816	·819	·821	·824	·827	·822	·831	·827	·828	·828	·840
1882 ...	·845	·845	·844	·828	·825	·828	·830	·830	·837	·822	·816	·834
1883 .	·836	·837	·834	·837	·848	·849	·847	·852	·845	·851	·856	·871
1884 ...	·876	·876	·868	·868	·872	·871	·870	·879	·886	·885	·893	·905
1885 ...	·901	·907	·907	·909	·906	·908	·913	·914	·917	·920	·928	·936
1886 ...	·932	·946	·943	·944	·946	·958	·953	·962	·973	·971	·979	·987
1887 ...	·991	·996	·996	·999	3·007	3·009	3·013	3·016	3·015	3·021	3·029	3·037
1888 ..	3·043	3·042	3·042	3·043	·048	·054	·055	·058	·057	·064	·063	·078

Recourse was had to the magnetometer readings for correction to the mean of the month in the following cases:—

a. For three of the five monthly observations of this month when the magnetograph enclosure was being exhausted and the declination curves were lost.

b. For one of the four monthly observations of this month for the same reason.

c. For one of the four monthly observations of this month when the magnetograph clock was being cleaned and the curve was lost.

d. For one of the five monthly observations of this month for the same reason.

Noting that increasing ordinates of the declination magnetograms imply decreasing easterly declination, the excesses of the numbers in the first half of this table over the corresponding numbers in the second half, are first converted into arc by the factor 28″·72, and then added* to the corresponding observed values of the absolute declination given in the first half of Table I: the results are shown in Table IV :—

TABLE IV.

Year.	Observed Absolute Declination, corrected to the mean monthly tabulation of the Declination Magnetograph.																							
	January.		February.		March.		April.		May.		June.		July.		August.		September.		October.		November.		December.	
	′	″	′	″	′	″	′	″	′	″	′	″	′	″	′	″	′	″	′	″	′	″	′	″
1871...	49	55	50	16	50	34	51	1	51	1	50	38	50	56	51	31	51	15	52	1	52	33	52	26
1872...	52	35	52	40	52	52	53	11	52	31	52	42	52	36	53	5	53	18	53	41	53	44	53	36
1873...	53	54	53	42	53	49	53	47	54	2	54	0	54	23	54	37	54	7	53	57	53	58	53	50
1874...	53	41	54	5	54	18	54	17	54	15	54	35	54	27	54	23	54	27	54	49	54	50	55	5
1875...	54	55	55	11	55	26	55	29	55	42	55	26	55	22	55	20	55	1	55	16	55	27	55	51
1876...	55	54	55	48	55	47	55	31	55	29	55	27	55	39	56	5	56	31	56	30	56	18	56	32
1877...	56	40	56	19	56	36	56	25	56	27	56	11	56	13	56	25	56	41	56	50	56	56	57	2
1878...	57	10	57	24	57	1	57	11	56	55	56	53	56	38	56	10	56	26	56	46	57	9	57	43
1879...	57	38	57	37	57	35	57	17	57	11	57	16	57	29	57	8	57	51	57	10	57	4	57	7
1880...	56	57	56	55	57	0	57	6	57	1	57	10	57	16	57	30	57	20	57	8	57	33	57	27
1881...	57	15	57	30	57	17	57	23	57	39	57	17	57	8	57	4	57	0	57	14	57	26	56	30
1882...	56	29	56	21	56	29	57	6	56	49	56	46	56	49	56	37	56	46	57	26	57	47	57	20
1883...	57	20	57	42	57	32	57	27	56	55	57	43	57	27	56	57	56	55	56	46	56	8	55	48
1884...	55	31	55	51	56	1	55	57	55	34	55	40	55	34	55	44	55	15	55	21	55	19	55	8
1885...	55	21	55	12	55	3	55	11	55	22	55	22	55	10	55	6	55	1	54	34	54	34	54	27
1886...	54	31	53	53	53	52	53	30	53	15	53	20	53	39	53	27	53	3	53	1	53	6	53	4
1887...	53	4	53	16	53	3	52	47	52	17	52	25	52	10	52	2	52	2	51	43	51	52	51	40
1888...	51	13	51	37	51	46	52	10	51	51	51	16	51	21	51	11	51	1	51	3	50	57	50	11

5. The annual means of the numbers in this table and in the first halves of Tables I and II are shown in Table V.

TABLE V.

Annual means of the observed Absolute Declination (1) *uncorrected and* (2) *corrected*
(*a*) *to the mean monthly reading of Grubb's Declination Magnetometer, and*
(*b*) *to the mean monthly tabulation of the Declination Magnetograph.*

Year.	Uncorrected.	Corrected by Magnetometer.		Corrected by Magnetograph.	a minus b.
		a.	Annual increment.	b.	
1	2	3	4	5	6
	′ ″	′ ″	′ ″	′ ″	′ ″
1868...	43 57	45 4	+ 2 25	.....	.....
1869...	46 8	47 29	+ 1 52	.....	.....
1870...	47 47	49 21	+ 1 52	.....	.....
1871...	49 38	51 13	+ 1 50	51 11	+ 0 2
1872...	51 34	53 3	+ 0 57	53 3	0 0
1873...	52 38	54 0	+ 0 27	54 0	0 0
1874...	53 26	54 27	+ 0 54	54 26	+ 0 1
1875...	54 26	55 21	+ 0 37	55 22	— 0 1
1876...	55 3	55 58	+ 0 41	55 58	0 0
1877...	55 28	56 39	+ 0 27	56 34	+ 0 5
1878...	56 0	57 6	+ 0 24	56 57	+ 0 9
1879...	56 26	57 30	— 0 21	57 22	+ 0 8
1880...	56 21	57 9	+ 0 3	57 12	— 0 3
1881...	55 55	57 12	— 0 22	57 14	— 0 2
1882...	55 55	56 50	+ 0 12	56 54	— 0 4
1883...	55 55	57 2	— 1 23	57 3	— 0 1
1884...	54 33	55 39	— 0 36	55 28	+ 0 11
1885...	53 52	55 3	— 1 35	55 2	+ 0 1
1886...	52 34	53 28	— 1 7	53 28	0 0
1887...	51 13	52 21	— 0 59	52 22	— 0 1
1888...	50 4	51 22	— 1 53	51 18	+ 0 4
1889...	48 13	49 29	— 1 55	.....	.....
1890...	46 22	47 34		.....	.....

* Added because increase of tabulation denotes decrease of declination, whilst increase of scale-reading denotes increase of declination.

6. To put the correction to the observed absolute declination in symbolic form, let D represent the absolute observed declination, C the excess—converted into arc—of the corresponding reading of the magnetometer over the monthly mean reading of the same, and c the similar excess—converted into arc—of the corresponding tabulation of the magnetograph over the monthly mean; then the numbers represented by a and b in the above table are equivalent to $D-C$ and $D+c$ respectively, and $a-b=D-C-(D+c)=-(c+C)$; and if the annual means of D, C and c are taken each in the same way, viz.: first by months and then by years, the same form will hold good with respect to them. Now if, in that case, the probable error of C be represented by $\pm\ \Delta C$ and that of c by $\pm\ \Delta c$ the probable error of $(c+C)$ will be $\pm\ \sqrt{(\Delta C)^2+(\Delta c)^2}$.

7. But in correcting the observed values of the absolute declination by means of the magnetometer readings and magnetograph tabulations in the manner described, the assumption is tacitly made that the variations of declination at the place where the absolute declination is observed (the Electrometer Tower) are the same during the course of each month as at the places of the magnetometer and magnetograph respectively: and the values in Table V of $(a-b)$, being independently determined for each year, may therefore be taken to include not only errors of observation of the quantity C and of measurement of the quantity c, but any systematic difference that there may be between the variations of declination at the places of the magnetometer and magnetograph; and in favour of regarding these values rather as errors than as systematic changes we may point out that there are nearly as many with negative as with positive signs, and that the average of them is only 1″·6 or approaches very near to zero. Hence the quantity $\sqrt{\frac{\Sigma(a-b)^2}{n-1}} \times \cdot 674489$ derived from the series of n excesses $(a-b)$, viz.: 3″·0, must be at least as great as the probable error apart from any constant affection of the excesses.* And $\pm\cdot 674489 \times \sqrt{\frac{\Sigma(a-b)^2}{n-1}} = \pm\ 674489 \times \sqrt{\frac{\Sigma(c+C)^2}{n-1}} = \pm\ 3''\cdot 0$ must be at least as great as $\pm\ \sqrt{(\Delta C)^2+(\Delta c)^2}$, from which it follows that neither ΔC nor Δc can exceed 3″·0.

8. Thus we find that, as affected by the corrections C and c, the probable error of the numbers a and b is not greater than 3″·0; and we may choose either series indifferently from which to determine the character of the secular variation of absolute declination: the series a has however the advantage of being more extensive and is therefore to be preferred. And first, a graphical representation is made of the numbers in Plate I, the abscissæ indicating time and the ordinates values of the absolute declination taken as the series a in Fig. 2 (strong line) and as the series b in Fig. 5.

9. The feature of both curves which overwhelms all others, is indicative of the gradual passage of the annual secular change from an increasing easterly declination to a decreasing easterly declination; a feature that implies that, during the period embraced by the observations, the great periodicity, with a cycle of several hundred years, that we call the secular variation has passed through a turning point, and that for the first time since the dawn of the era of continuous systematic record. But by further curving the annual increments of declination, as shown by the numbers in column 4 of Table V, we learn that the increments are subject to an approximately steady rate of decrease, so that the annual values of declination may be represented by the formula

$$\delta = at^2 + bt + c$$

where t is the year, reckoned from a convenient initial year, and a, b and c are constants. The series of values of the absolute declination for 1868 to 1888 given in column 3 of Table V then afford twenty-one equations of condition from which to determine a, b and c. Taking 1865·5 as the initial year and expressing the declination in seconds of arc these come out

$$a = -5\cdot 06\,;\ b = +\ 148\cdot 10\,;\ c = +2353\cdot 54\,;$$

and then reversing the process and calculating values of δ for each year, we obtain the numbers shown in column 3 of the next table.

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* The addition of any constant number d to a series of n numbers $(c-C)$ whose sum is *zero*, produces a series of which $\sqrt{\frac{\Sigma\{(c-C)+d\}^2}{n-1}}$ is greater than $\sqrt{\frac{\Sigma(c-C)^2}{n-1}}$; for $\Sigma\{(c-C)+d\}^2 = \Sigma(c-C)^2 + nd^2 + 2d\,\Sigma(c-C)$ and the last term vanishes because $\Sigma(c-C) = 0$.

TABLE VI.

Year.	Absolute Declination.				Observed minus Calculated.	
	Observed.		Calculated.			
	′	″	′	″	′	″
1868	45	4	45	52	—0	48
1869	47	29	47	45	—0	16
1870	49	21	49	28	—0	7
1871	51	13	51	0	+0	13
1872	53	3	52	22	+0	41
1873	54	0	53	34	+0	26
1874	54	27	54	37	—0	10
1875	55	21	55	29	- 0	8
1876	55	58	56	10	—0	12
1877	56	39	56	42	—0	3
1878	57	6	57	4	+0	2
1879	57	30	57	15	+0	15
1880	57	9	57	17	—0	8
1881	57	12	57	8	+0	4
1882	56	50	56	49	+0	1
1883	57	2	56	20	+0	42
1884	55	39	55	41	—0	2
1885	55	3	54	52	+0	11
1886	53	28	53	52	—0	24
1887	52	21	52	43	—0	22
1888	51	22	51	23	—0	1
1889	49	29	49	53	—0	24
1890	47	34	48	14	—0	40

10. The probable error yielded by the 21 excesses for the years 1868 to 1888 of the last column of this table is $\pm 14''\cdot1$, which must be regarded rather as deviation from the assumed law of growth of the secular increment than as error of the determinations of annual absolute declination. Indeed it was shown in Appendix IV to the "Bombay Magnetical and Meteorological Observations, 1865—70", page 252, that the latter amounted only to $\pm 3''\cdot1$, $\pm 3''\cdot0$ and $\pm 2''\cdot0$ for the years 1868, 1869 and 1870 respectively, quantities that may be ignored in presence of a deviation from rule of $+14''\cdot1$. Consequently as this unexpectedly large discrepancy is neither due to error of the absolute determinations nor to the magnetometer corrections (C) applied to them, it must be attributed to a real irregularity in the annual growth of the absolute declination. It will be seen later that there can be no doubt about there being such irregularity of growth in the absolute horizontal force, and there should, therefore, be the less hesitation in admitting its probable existence in another element of the Earth's magnetic force. The irregularity is, however, small in comparison with the general agreement of the observed and calculated numbers in columns 2 and 3 of Table VI, a fact that is seen at a glance in the two curves of Fig. 2, the thin-line one of which represents the calculated values of the annual mean declination. Nevertheless the direct results of observation are the annual increments shown in column 4 of Table V, and the formula at^2+bt+c must be regarded as only approximately representing the facts in the neighbourhood of the turning point of the secular variation. For that region it gives the time at which the annual increment vanishes as 1880·13; for $\frac{d\delta}{dt} = 2at + b = 0$ when $t = -\frac{b}{2a} = \frac{148'10}{10'12} = 14\cdot63$, and adding the initial time 1865·5, this becomes 1880·13.

11. *The declination magnemtometer and magnetograph as indicators of secular change.*—Having explained that the probable error ($\pm 3''\cdot0$) of the corrections C and c includes any systematic difference that there may be in the variation of declination at the places of the magnetometer and magnetograph, we may—conversely—conclude that the probable error of annual mean of absolute declination, involved in assuming the equality of the variations at the two places during each month is not greater than $\pm 3''\cdot0$. There may, however, in the course of a year or, still more, in a series of years, be accumulation of systematic difference, and it is a fit subject of inquiry whether the probable error

increases when the assumption is extended to apply to a series of years: or it may be that the indications of the magnetometer and magnetograph are affected by other causes than changes of magnetic declination, such—for instance—as variability in the torsion force exerted by the silk suspension thread upon the magnet,* and such affections would, if the scale-readings of these instruments were treated on the extended assumption, similarly lead to an enlargement of the probable error. For the purposes of this inquiry let us assume the annual means of the determinations of declination which we have seen to be subject to very small errors, to be practically free from error. Then reducing them to a constant reading of the magnetometer, or to a constant tabulation of the magnetograph, we shall obtain two series of numbers the inverse variation of which will indicate what we may call the specific variability of the magetometer and of the magnetograph respectively, meaning by specific variability that which is in excess of the variations of declination in the Electrometer Tower *plus* any non-magnetic affections of the indications of the two instruments. Or the specific variability may be otherwise obtained by converting the mean annual readings or tabulations into arc, to which may be added any convenient constant, and then deducting the annual means of the absolute determinations. The data for and results of these calulations are shown in Table VII:—

TABLE VII.

Year.	Annual mean of absolute determinations reduced to the monthly mean reading of Grubb's declination magnetometer.	Annual mean scale reading of magnetometer.	Column 3 converted into arc *minus* 195′ 48″ a	Column 4 *minus* Column 2.	Annual mean of absolute determinations reduced to the monthly mean tabulation of declination magnetograph.	Annual mean tabulation of magnetograph.	138′ 28″ *minus* Column 7 converted into arc.	Column 8 *minus* Column 6.	Force in *true eastward direction* m.m.—m.g.—s units.
1	2	3	4	5	6	7	8	9	10
	′ ″		′ ″	′ ″	′ ″		′ ″	′ ″	
1868	45 4	35·435	46 3	+0 59	.....	...	...	...	·0487
1869	47 29	35·697	47 50	+0 21	.....	...	...	...	·0513
1870	49 21	36·034	50 8	+0 47	.....	...	...	...	·0534
1871	51 13	36·321	52 5	+0 52	51 11	3·028	51 30	+0 19	·0554
1872	53 3	36·527	53 30	+0 27	53 3	2·971	53 8	+0 5	·0574
1873	54 0	36·629	54 12	+0 12	54 0	2·947	53 50	−0 10	·0585
1874	54 27	36·718	54 48	+0 21	54 26	2·926	54 26	0 0	·0590
1875	55 21	36·830	55 34	+0 13	55 22	2·903	55 6	−0 16	·0601
1876	55 58	36·908	56 6	+0 8	55 58	2·890	56 9	+0 11	·0608
1877	56 39	36·957	56 26	−0 13	56 34	2·836	57 1	+0 27	·0615
1878	57 6	36·999	56 43	−0 23	56 57	2·823	57 23	+0 26	·0620
1879	57 30	37·025	56 54	−0 36	57 22	2·822	57 25	+0 3	·0625
1880	57 9	37·007	56 46	−0 23	57 12	2·816	57 35	+0 23	·0621
1881	57 12	37·041	57 0	−0 12	57 14	2·826	57 18	+0 4	·0622
1882	56 50	36·859	55 46	−1 4	56 54	2·832	57 8	+0 14	·0617
1883	57 2	36·989	56 39	−0 23	57 3	2·847	56 42	−0 21	·0620
1884	55 39	36·826	55 32	−0 7	55 28	2·879	55 47	+0 19	·0606
1885	55 3	36·652	54 21	−0 42	55 2	2·914	54 47	−0 15	·0599
1886	53 28	36·494	53 16	−0 12	53 28	2·958	53 31	+0 3	·0582
1887	52 21	36·279	51 48	−0 33	52 22	3·011	52 0	−0 22	·0570
1888	51 22	36·175	51 6	−0 16	51 18	3·054	50 46	−0 32	·0559
1889	49 29	35·882	49 6	−0 23	.....	...	...	...	·0539
1890	47 34	35·617	47 17	−0 17	.....	...	...	...	·0518

The numbers in columns 3 and 7 are the annual means of the numbers in the last halves of Tables II and III respectively; those in columns 4 and 8 are the same converted into arc with the respective coefficients 6·825 and 28·72 and added to or subtracted from the respective constants—195′ 48″ and +138′ 28″; and those in columns 5 and 9 are the specific variabilities of the magnetometer and magnetograph respectively. The latter numbers are curved in Figs. 6 and 7 on Plate I.

12. It is, of course, impossible to say how much of these variations are due to magnetic differences and how much to non-magnetic affections; but the general correspondence of movement on the two curves, between 1871 and 1875, between 1877 and 1880 and between 1883 and 1887 would seem to imply that those movements were due to real differences in the growth of secular change of declination at the Electrometer Tower and similarity of growth at the places of the magnetometer and magnetograph, whilst the remaining characteristics of the curves would seem to be attributable, with greater probability, to non-magnetic affections of the differential instruments. In the case of the magnetograph it is, however, difficult to conceive what such affections can

* It has been resolved to try at this Observatory, if found practicable, the experiment of substituting a quartz fibre for bundles of silk threads for the suspension of the magnet, both in this instrument and the absolute declinometer and vibration and deflection apparatus.

have arisen from, for since July 18, 1876, the magnet has been without interruption in an absolutely air-tight enclosure, filled with a dry atmosphere at a pressure of only 2·28 inches of mercury, and both the zero mirror and the magnet mirror have necessarily been undisturbed. As to the magnetometer plenty of evidence is afforded by the experience of this and other Observatories that frequent disturbance of the adjustment of instruments of its class is fatal to the accurate determination by it of the secular variation, successive renewals of the suspension thread, when other things remain the same, giving largely varying values of the scale-reading. Hence, it has long been the practice at this Observatory, whilst keeping a careful watch on the instrument and its indications,* to refrain as long as possible from disturbing the suspension arrangements: but in the course of many years, it was found that the putty with which the crevices in the enclosing box had been filled had dried and broken up into small fragments, and the layers of calico and paper that had been glued over it had been much eaten by cockroaches, and in October 1883 the box was opened and a number of spider lines were discovered connecting the magnet with the frame-work of the box: these were removed and everything made clean, and the box was closed and its crevices filled again with fresh putty and then coated with French polish. Comparison of the magnetometer and magnetograph records one day before opening the box and one day after closing it again showed that a sensible though small effect was produced by the removal of the spider lines, but as some of these were attached at both sides and both ends of the magnet, the effect found (29″) may have been only a balance of counteracting pulls, and the preceding year's very abnormal mean scale-reading may still have been such by reason of one or more spiders having gained access to the interior of the box. To test whether this was the case, a careful search was made for sudden changes of scale-reading which had no counterparts in the movements of the declination magnetograph, and several were found between November 1881 and October 1883, some in one direction and some in the other—as might be expected from the attachment of new spider lines or the breakage of others—but never exceeding in their aggregate departure from correspondence with the magnetograph an arc of one minute. Nevertheless the departure from parallelism of movement of the magnets of the differential declination magnetomter and magnetograph and the absolute determinations—though larger than could well have been anticipated—are small in comparison with the extent of agreement in the general march of both under the influence of secular change as shown by the absolute determinations; and, except during the years 1876 to 1879, and that in the case of the magnetometer only and amounting in all to less than a minute of arc, there is little evidence of any cumulative departure. That the general movements of the magnetometer and magnetograph are mainly accordant with the absolute determinations will be seen at once on inspection of Figs. 2, 3 and 4, the last two of which curves are constructed from the numbers in columns 4 and 8 of Table VII.

13. *Other results brought to light by means of the foregoing investigation.*—Besides the search for casual erratic movements of the magnetometer, referred to in the last paragraph, it was thought desirable to compare month by month the mean tabulations with the mean scale-readings: each of the mean tabulations was converted into scale-reading by the factor 4·21 ($=\frac{28\cdot72}{6\cdot825}$) and then added† to the corresponding mean scale-reading: a convenient constant (48·50) was subtracted from the numbers thus found, and the differences converted into seconds of arc. The converted differences appear on Plate I. as Fig. 12.

If the correspondence between the indications of the two instruments were exact, all the points of Fig. 12 should lie on the same horizontal line, as roughly speaking they do: but two significant features will be noticed in the curve; first that the parts of it from near the end of 1881 to near the end of 1883 deviate considerably from the general course of the curve, this being in fact the clue that led to the closer examination of the scale-readings of that period in search of sudden movements; and secondly that there is a systematic annual periodicity in certain years of the curve whilst other years display little more than casual oscillations, the years 1873 to 1876 and 1884 to 1887 being of the former kind and

* As a means of detecting abnormal constraint of the declination magnetometer the practice was introduced in April 1867 of observing with it, in adjustment, a set of vibration observations once a month, and it was continued until the end of 1884, since which year the observations have been taken once a year only. Also, with a view to breaking any possible spider lines connecting the magnet with the fixed parts of the instrument, the magnet has, since July 1876, regularly once a month been made to vibrate through an arc of one degree, and to measure the effect of such possible breakage the scale has been read since January 1882, immediately before and immediately after each operation. With the proviso that January 1882 should be substituted for July 1876 this note applies also to Grubb's horizontal force magnetometer.

† Added because increase of tabulation denotes decrease of declination whilst increase of scale-reading denotes increase of declination.

the rest of the latter kind. The mean annual variations for these two periods, for the rest of the years, and for the whole series of years respectively are graphically represented by Figs. 8, 9, 10 and 11. Had this periodicity shown itself indiscriminately in all years, it might perhaps have been attributed to a variation of the torsion force of the suspension thread of the magnetometer corresponding to succession of dry and wet seasons in the weather; but as it appears at the same phase of two successive sun-spot periods, it may possibly imply that the magnetic disturbances that occur at that phase of the period affect one of the two instruments in larger proportion than the other; whilst the larger disturbances that occur near the time of maximum of the period affect both instruments more nearly alike, the one instrument being above and the other below the ground surface.

14. Another curious result obtained is that the specific variability of the declination magnetograph has in it a periodicity which definitely re-appears in each two years of the period from 1874·0 to 1888·0. It is found by reducing the monthly determination of absolute declination to a constant tabulation of the magnetograph; and its character and range, in the mean of the 7 cycles, is shown by Fig. 13: it means that the easterly declination in the Electrometer Tower varies in excess of the variation in the magnetograph room in the manner indicated by the curve.

15. *Annual variation.*—The means for the period 1868 to 1890 of absolute easterly declination in each month, as corrected to the mean monthly scale-reading of Grubb's declination magnetometer, are as shown in Table VIII.; and the same means corrected for secular change at the mean rate of + 7″ per annum are also shown in the same table, as well as the annual variation of these. The latter it will be observed is of minute range, the greatest and least monthly inequalities being + 7″ and − 9″.

TABLE VIII.

Month.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Year.
	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″
Mean declination ...	53 18	53 24	53 30	53 36	53 28	53 27	53 29	53 35	53 31	53 34	53 36	53 28	...
Corrected for secular change	53 21	53 27	53 32	53 37	53 29	53 28	53 29	53 35	53 30	53 32	53 33	53 25	53 30
Annual variation ...	−0 9	−0 3	+0 2	+0 7	−0 1	−0 2	−0 1	+0 5	0 0	+0 2	+0 3	−0 5	...

II.—HORIZONTAL FORCE.

16. *Monthly mean values.** In Table IX are collected the mean monthly values, as observed, of the horizontal force for the period from July 1867 to December 1890, and the corresponding monthly mean readings of Grubb's horizontal force magnetometer, corrected to the constant temperature 82° Fahr. In correcting the magnetometer readings 0·15 has been adopted as the decrease of reading produced by an increase of 1° of temperature.

TABLE IX.

Year.	Mean observed Absolute Horizontal Force.												Corresponding mean Scale-reading of Grubb's Horizontal Force Magnetometer corrected to Temperature 82°·0.											
	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1867	...	...	...	...	...	...	8·0494	8·0612	8·0508	8·0569	8·0523	8·0593	...	...	...	...	...	...	23·53	23·41	23·37	23·32	24·09	24·27
1868	8·0608	8·0556	8·0597	8·0595	8·0614	8·0668	8·0651	8·0490	8·0546	8·0637	8·0659	8·0588	24·60	24·61	24·48	23·79	24·32	24·54	24·07	24·15	23·29	24·10	24·51	24·42
1869	8·0616	8·0688	8·0655	8·0616	8·0547	8·0683	8·0695	8·0633	8·0710	8·0646	8·0690	8·0625	24·30	24·07	24·29	24·34	24·09	24·84	24·84	24·25	24·31	24·45	24·48	24·74
1870	8·0655	8·0670	8·0758	8·0697	8·0706	8·0818	8·0756	8·0768	8·0700	8·0687	8·0680	8·0787	24·77	24·72	25·26	24·90	25·49	25·62	25·21	25·15	24·35	24·56	24·73	25·59
1871	8·0768	8·0791	8·0774	8·0743	8·0742	8·0790	8·0819	8·0808	8·0824	8·0799	8·0757	8·0710	25·57	25·61	25·64	25·35	25·80	25·78	25·54	25·42	25·56	25·11	25·37	25·59
1872	8·0727	8·0743	8·0818	8·0873	8·0876	8·0844	8·0811	8·0813	8·0808	8·0753	8·0769	8·0795	25·89	25·95	25·96	26·15	26·32	25·79	25·67	25·64	25·39	25·18	25·65	25·38
1873	8·0750	8·0811	8·0830	8·0856	8·0859	8·0874	8·0889	8·0847	8·0828	8·0853	8·0841	8·0849	...	10·47	10·50	10·64	10·76	10·88	10·93	10·72	10·83	10·99	11·35	11·61
1874	8·0871	8·0852	8·0873	8·0872	8·0900	8·0897	8·0930	8·0949	8·0918	8·0912	8·0907	8·0916	11·60	11·77	12·12	11·46	11·88	11·79	12·06	11·95	11·82	11·47	12·00	12·23
1875	8·0909	8·0915	8·0931	8·0942	8·0948	8·0965	8·0954	8·0955	8·0949	8·0978	8·0974	8·0948	12·47	12·76	12·38	12·38	12·47	12·69	12·39	12·57	12·43	12·43	12·61	12·96
1876	8·0946	8·0943	8·0986	8·1017	8·1019	8·1012	8·1029	8·1031	8·1004	8·1007	8·1017	8·1083	13·29	13·04	13·34	13·42	13·31	13·33	13·35	13·23	12·87	12·97	13·36	13·36
1877	8·1003	8·1017	8·1024	8·1018	8·1009	8·0984	8·1019	8·1004	8·0986	8·1039	8·1028	8·1028	13·56	13·64	13·63	13·51	13·56	13·55	13·54	13·39	13·30	13·63	13·55	13·76
1878	8·1040	8·1004	8·1061	8·1022	8·1005	8·0998	8·1078	8·1057	8·1063	8·1049	8·1065	8·1076	13·97	13·73	14·05	13·86	13·88	13·66	14·02	13·69	13·77	13·65	13·81	14·02
1879	8·1044	8·1066	8·1090	8·1112	8·1067	8·1067	8·1101	8·1089	8·1067	8·1087	8·1036	8·1064	14·15	14·33	14·35	14·33	14·03	13·79	13·94	13·88	13·74	13·91	13·93	14·33
1880	8·1108	8·1119	8·1098	8·1155	8·1085	8·1063	8·1086	8·1080	8·0989	8·1033	8·1000	8·1031	14·41	14·50	14·38	14·57	14·23	14·14	14·07	14·13	13·41	13·96	13·70	13·85
1881	8·1057	8·1047	8·1066	8·1054	8·1076	8·1078	8·1092	8·1087	8·1044	8·1064	8·1000	8·1028	14·27	14·04	14·43	14·48	14·42	14·38	14·24	14·25	13·85	14·03	13·77	14·29
1882	8·1036	8·1046	8·1069	8·1013	8·1014	8·1018	8·1043	8·1033	8·1026	8·1011	8·0985	8·0995	14·45	14·43	14·52	14·12	14·19	13·91	14·03	13·81	13·80	13·54	13·71	13·87
1883	8·1039	8·1043	8·1009	8·1014	8·1090	8·1104	8·1105	8·1123	8·1110	8·1136	8·1162	8·1141	14·24	14·34	14·11	13·81	14·38	14·39	14·31	14·21	13·81	14·08	14·33	14·73
1884	8·1157	8·1141	8·1195	8·1247	8·1223	8·1245	8·1222	8·1232	8·1184	8·1161	8·1161	8·1173	14·84	14·89	15·18	15·21	14·89	15·15	14·85	14·97	14·68	14·61	14·77	15·02
1885	8·1174	8·1170	8·1194	8·1158	8·1159	8·1193	8·1187	8·1172	8·1141	8·1186	8·1185	8·1156	14·98	15·42	15·34	15·10	14·83	15·11	15·13	14·96	14·53	15·06	15·31	15·45
1886	8·1141	8·1173	8·1180	8·1157	8·1160	8·1167	8·1145	8·1179	8·1150	8·1137	8·1106	8·1070	15·32	15·60	15·32	15·05	15·16	15·01	14·81	14·96	14·91	14·81	14·93	14·91
1887	8·1137	8·1168	8·1148	8·1145	8·1142	8·1168	8·1169	8·1151	8·1160	8·1187	8·1179	8·1149	15·11	15·28	15·30	15·28	15·10	15·39	15·28	14·97	14·87	15·17	15·28	15·32
1888	8·1170	8·1211	8·1232	8·1184	8·1185	8·1202	8·1195	8·1190	8·1195	8·1210	8·1147	8·1189	15·36	15·65	15·82	15·38	15·44	15·53	15·36	15·38	15·25	15·46	15·34	15·73
1889	8·1179	8·1204	8·1181	8·1212	8·1183	8·1208	8·1204	8·1204	8·1179	8·1210	8·1194	8·1207	15·81	16·05	15·72	15·89	15·53	15·74	15·37	15·30	15·05	15·32	15·42	15·74
1890	8·1197	8·1194	8·1219	8·1212	8·1216	8·1223	8·1242	8·1236	8·1187	8·1207	8·1200	8·1203	15·79	15·94	15·96	15·84	15·83	15·80	15·73	15·47	15·32	15·50	15·53	15·74

17. Table X corresponds with Table IX, except that the mean monthly readings deduced from all the hourly observations of Grubb's horizontal force magnetometer are given instead of those which correspond to the times of the absolute observations only; and the values of horizontal force are corrected for the difference between the two sets of mean monthly readings, so as to represent the values of the *mean* horizontal force for the several months. The scale-coefficient adopted for Grubb's horizontal force magnetometer was for 1867 to 1873 $dX = \cdot01200$; for 1874 to 1878 $dX = \cdot01244$; for 1879 to 1883 $dX = \cdot01246$; for 1884 and 1885 $dX = \cdot01247$; for 1886 to 1888 $dX = \cdot01248$; for 1889 $dX = \cdot01250$ and for 1890 $dX = \cdot01253$.

* Expressed in foot-grain-second units of force, the final results only being converted into millimetre-milligramme-second units by applying the constant factor ·46108.

Table X.

Year.	Monthly mean Absolute Horizontal Force reduced to monthly mean readings of Grubb's Horizontal Force Magnetometer.												Monthly mean reading of Grubb's Horizontal Force Magnetometer corrected to Temperature 32°·0											
	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1867...	...	...	...	...	...	...	8·0480	8·0593	8·0473	8·0547	8·0487	8·0564	...	...	...	...	...	...	23·41	23·25	23·08	23·14	23·79	24·03
1868...	8·0556	8·0491	8·0551	8·0606	8·0578	8·0602	8·0617	8·0444	8·0568	8·0573	8·0612	8·0554	24·17	24·07	24·10	23·88	24·02	23·99	23·79	23·77	23·47	23·57	24·12	24·14
1869...	8·0584	8·0680	8·0629	8·0552	8·0524	8·0592	8·0613	8·0580	8·0619	8·0576	8·0671	8·0582	24·03	24·00	24·07	23·81	23·90	24·08	24·16	23·81	23·55	23·87	24·32	24·38
1870...	8·0581	8·0610	8·0654	8·0627	8·0611	8·0708	8·0702	8·0672	8·0642	8·0604	8·0630	8·0685	24·15	24·22	24·38	24·32	24·70	24·70	24·76	24·35	23·87	23·87	24·31	24·74
1871...	8·0674	8·0681	8·0673	8·0628	8·0658	8·0705	8·0735	8·0713	8·0718	8·0752	8·0657	8·0662	24·79	24·69	24·82	24·39	25·19	25·07	24·84	24·63	24·68	24·72	24·54	25·19
1872...	8·0668	8·0643	8·0718	8·0770	8·0793	8·0791	8·0746	8·0715	8·0744	8·0691	8·0707	8·0752	25·40	25·12	25·13	25·29	25·63	25·35	25·13	24·82	24·86	24·66	25·13	25·02
1873...	8··725	8·0727	8·0757	8·0802	8·0816	8·0809	8·0833	8·0822	8·0791	8·0809	8·0793	8·0814	...	9·77	9·89	10·19	10·40	10·34	10·46	10·51	10·52	10·62	10·95	11·32
1874...	8·0836	8·0776	8·0789	8·0849	8·0862	8·0873	8·0866	8·0894	8·0875	8·0859	8·0863	8·0879	11·31	11·14	11·42	11·27	11·56	11·59	11·53	11·49	11·46	11·28	11·62	11·92
1875...	8·0874	8·0845	8·0878	8·0918	8·0925	8·0933	8·0934	8·0918	8·0901	8·0933	8·0958	8·0916	12·18	12·18	11·94	12·18	12·28	12·42	12·22	12·26	12·03	12·22	12·48	12·69
1876...	8·0899	8·0921	8·0928	8·0962	8·0983	8·0981	8·0977	8·0985	8·0991	8·0985	8·0973	8·0955	12·90	12·86	12·86	12·96	13·01	13·07	12·92	12·85	12·76	12·79	12·99	13·13
1877...	8·0966	8·0987	8·0984	8·0989	8·0963	8·0946	8·0985	8·0987	8·0978	8·0989	8·0997	8·0996	13·25	13·39	13·30	13·27	13·18	13·23	13·26	13·25	13·23	13·21	13·29	13·49
1878...	8·0999	8·0993	8·1021	8·1000	8·0976	8·0987	8·1032	8·1033	8·1011	8·1014	8·1028	8·1034	13·63	13·64	13·72	13·68	13·64	13·57	13·64	13·49	13·24	13·36	13·48	13·67
1879...	8·1020	8·1041	8·1036	8·1057	8·1031	8·1051	8·1062	8·1048	8·1026	8·1043	8·1014	8·1013	13·96	14·13	13·92	13·89	13·74	13·66	13·63	13·55	13·41	13·56	13·75	13·92
1880...	8·1051	8·1080	8·1043	8·1089	8·1048	8·1044	8·1055	8·0982	8·1001	8·0987	8·0985	8·1011	13·95	14·19	13·94	14·04	13·93	13·99	13·82	13·34	13·51	13·59	13·58	13·69
1881...	8·1021	8·1011	8·1011	8·0987	8·1029	8·1032	8·1046	8·1040	8·1004	8·1023	8·0995	8·0988	13·98	13·75	13·99	13·94	14·04	14·01	13·87	13·87	13·53	13·70	13·73	13·92
1882...	8·0990	8·0995	8·1022	8·0944	8·0957	8·0989	8·1003	8·0983	8·1014	8·0985	8·0915	8·0944	14·08	14·02	14·14	13·57	13·73	13·68	13·71	13·41	13·70	13·33	13·15	13·46
1883...	8·0995	8·0998	8·0987	8·1031	8·1054	8·1062	8·1045	8·1082	8·1080	8·1097	8·1116	8·1096	13·89	13·98	13·93	13·95	14·09	14·05	13·83	13·88	13·57	13·77	13·96	14·37
1884...	8·1121	8·1096	8·1100	8·1150	8·1173	8·1171	8·1160	8·1166	8·1140	8·1117	8·1120	8·1134	14·55	14·53	14·42	14·43	14·49	14·50	14·35	14·44	14·33	14·26	14·44	14·71
1885...	8·1130	8·1110	8·1134	8·1127	8·1130	8·1138	8·1148	8·1121	8·1127	8·1136	8·1141	8·1134	14·63	14·94	14·86	14·85	14·60	14·67	14·82	14·55	14·42	14·66	14·96	15·27
1886...	8·1105	8·1136	8·1163	8·1140	8·1124	8·1155	8·1130	8·1137	8·1120	8·1105	8·1075	8·1066	15·03	15·30	15·18	14·93	14·87	14·91	14·69	14·62	14·67	14·55	14·68	14·88
1887...	8·1116	8·1144	8·1118	8·1104	8·1133	8·1126	8·1125	8·1129	8·1130	8·1137	8·1143	8·1132	14·94	15·09	15·06	14·95	15·03	15·05	14·93	14·79	14·63	14·77	14·99	15·18
1888...	8·1125	8·1152	8·1154	8·1158	8·1154	8·1160	8·1164	8·1143	8·1155	8·1159	8·1123	8·1159	15·00	15·18	15·19	15·17	15·19	15·19	15·11	15·00	14·93	15·05	15·15	15·49
1889...	8·1155	8·1154	8·1146	8·1162	8·1164	8·1163	8·1182	8·1180	8·1173	8·1181	8·1165	8·1166	15·62	15·63	15·44	15·49	15·38	15·38	15·19	15·11	15·00	15·09	15·19	15·41
1890...	8·1170	8·1172	8·1180	8·1181	8·1181	8·1191	8·1202	8·1207	8·1165	8·1157	8·1168	8·1176	15·57	15·76	15·65	15·59	15·55	15·54	15·41	15·24	15·14	15·10	15·27	15·52

18. During part of the month of January 1873, Grubb's horizontal force magnetometer was under re-adjustment, and the correction had to be deduced partly from its readings before re-adjustment, and partly from readings of the horizontal force magnetograph taken at the time of the absolute observations. From and after February 1873 the monthly mean readings of Grubb's horizontal force magnetometer were obtained by subtracting from the monthly mean for the five civil hours 6, 10, 14, 16 and 22, the excess, expressed in scale-readings, of the mean force at those hours in the years 1846 to 1872 above the mean force for the twenty-four hours in the same years. The excesses for the several months January to December are +·10, +·10, +·11, +·12, +·11, +·10, +·09, +·09, +·09, +·08, +·10 and +·10.

19. In Table XI are shown the annual means of the numbers in the first half of Table IX, in Table X, the values of horizontal force—uncorrected and corrected—converted into *m.m.*—*m.g.*—*s.* units, and the annual increments of the corrected values of the same; also the mean scale-readings of the horizontal force magnetometer, the annual increments thereof, the same converted into British units; and the annual sums of those increments increased by a convenient constant number for each of the periods before and after 1873; and finally the last numbers converted into *m.m.*—*m.g.*—*s.* units of force :—

TABLE XI.

Year.	Absolute Horizontal Force.					Graham's Horizontal Force Magnetometer.					
	Annual mean of absolute determinations observed.	Column 2 converted into *m.m.*—*m.g.*—*s.* units.	Annual mean of absolute determinations, reduced to monthly mean scale-reading of Grubb's horizontal force magnetometer.—In British units.	Column 4 converted into *m.m.*—*m.g.*—*s.* units.		Mean annual scale-reading.	Annual increment of scale-reading.	Column 8 converted into British units of force.	Sums of increments in Column 9 *plus* 8·1567 before 1873 —*plus* 8·0720 after 1873.	Column 10 converted into *m.m.*—*m.g.*—*s.* units of force.	Column 11 minus Column 5.
				Means.	Annual increments.						
1	2	3	4	5	6	7	8	9	10	11	12
1868	8·0601	3·7164	8·0563	3·7146		23·92			8·0567	3·7148	
1869	8·0650	3·7186	8·0600	3·7163	+·0017	24·00	+·08	+·0010	8·0577	3·7152	—·0011
1870	8·0723	3·7220	8·0644	3·7183	+·0020	24·36	+·36	+·0043	8·0620	3·7172	—·0011
1871	8·0777	3·7245	8·0688	3·7204	+·0021	24·79	+·43	+·0052	8·0672	3·7196	—·0008
1872	8·0802	3·7256	8·0728	3·7222	+·0018	25·13	+·34	+·0041	8·0713	3·7215	—·0007
1873	8·0841	3·7274	8·0791	3·7251	+·0029	...	...	...	...	...	...
1874	8·0900	3·7301	8·0854	3·7280	+·0029	11·47			8·0720	3·7218	—·0062
1875	8·0947	3·7323	8·0913	3·7307	+·0027	12·26	+·79	+·0098	8·0818	3·7264	—·0043
1876	8·0999	3·7347	8·0962	3·7330	+·0023	12·92	+·66	+·0082	8·0900	3·7301	—·0029
1877	8·1013	3·7353	8·0981	3·7339	+·0009	13·28	+·36	+·0045	8·0945	3·7322	—·0017
1878	8·1043	3·7367	8·1011	3·7353	+·0014	13·57	+·29	+·0036	8·0981	3·7339	—·0014
1879	8·1074	3·7382	8·1037	3·7365	+·0012	13·76	+·19	+·0024	8·1005	3·7350	—·0015
1880	8·1071	3·7380	8·1031	3·7362	—·0003	13·80	+·04	+·0005	8·1010	3·7352	—·0010
1881	8·1058	3·7374	8·1016	3·7355	—·0007	13·86	+·06	+·0007	8·1017	3·7355	·0000
1882	8·1024	3·7359	8·0978	3·7337	—·0018	13·66	—·20	—·0025	8·0992	3·7344	+·0007
1883	8·1090	3·7389	8·1054	3·7372	+·0035	13·94	+·28	+·0035	8·1027	3·7360	—·0012
1884	8·1195	3·7437	8·1137	3·7411	+·0039	14·46	+·52	+·0065	8·1092	3·7390	—·0021
1885	8·1173	3·7427	8·1131	3·7408	—·0003	14·77	+·31	+·0039	8·1131	3·7408	·0000
1886	8·1147	3·7415	8·1121	3·7403	—·0005	14·86	+·09	+·0011	8·1142	3·7413	+·0010
1887	8·1159	3·7421	8·1128	3·7406	+·0003	14·95	+·09	+·0011	8·1153	3·7418	+·0012
1888	8·1192	3·7436	8·1150	3·7417	+·0011	15·14	+·19	+·0024	8·1177	3·7429	+·0012
1889	8·1197	3·7438	8·1166	3·7424	+·0007	15·33	+·19	+·0024	8·1201	3·7440	+·0016
1890	8·1211	3·7445	8·1179	3·7430	+·0006	15·44	+·11	+·0014	8·1215	3·7447	+·0017

20. The numbers in columns 3, 5, 11 and 12 of this table are curved as Figs. 14 15, 16*a* and 16 and 17*a* and 17 respectively of Plate II. The annual increments in column 6 were also curved and it was noticed that between the years 1873 and 1882, they all lay nearly in a straight line, implying that their rate of decrease was uniform, and that for that period the annual values of the absolute horizontal force could be expressed in the form at^2+bt+c. Taking 1872·5 as the initial year the most probable values of the constants were found by the method of least squares to be

$$a=-\cdot000275\,;\quad b=+\cdot00405\,;\quad c=3\cdot72110\,;$$

and inserting these in the formula the calculated values of the horizontal force for the years 1873 to 1882, in order, were found to be 3·7249, 3·7281, 3·7308, 3·7329, 3·7345, 3·7355, 3·7359, 3·7359, 3·7353 and 3·7341 *m.m.*—*m.g.*—*s* units of force.

Taking the differences between the observed and calculated values and using them to calculate the probable error of an annual mean, this is found to be ±·0002, which may be taken rather as a measure of the agreement of the annual mean with the assumed law of secular variation during the ten years than as error of observation. It will be seen also from Fig. 15 that the thin-line curve, which represents the calculated values, is during that period practically coincident throughout with the thick-line curve of observed values.

21. From 1868 to 1872 the annual increments are practically constant with a mean value of +·0019; they increase to +·0029 between 1872 and 1874; then they follow the

law expressed by the above formula till 1882; there is a large increase in them from 1882 to 1884; then they all but vanish from 1884 to 1887; and lastly from 1887 to 1890 they have a nearly constant value of about +·0008. As the signs of the annual increments change, however, during the period 1868 to 1890 four times, there are in that period two maxima and two minima of horizontal force, the former occurring in 1879 and 1884 and the latter in 1882 and 1886. But ignoring for the moment the relatively small oscillations that occur between 1879 and 1886, it is clear from Fig. 15 that there is a general tendency towards a coming maximum of the great secular period: it must be admitted, however, that if the observations had ceased after 1882, and a similar inference had been drawn from the tendency of things at that time, it would have been to the effect that the maximum of the great secular period had been passed through, both in respect of the declination and horizontal force, in 1879; and this we now see would have been wrong in respect of the horizontal force. Indeed, publication of this investigation has been deferred for some years in order that further evidence on this point might become available. Deducing the time of maximum horizontal force in the ten years 1873 to 1882 from the constants a and b of the formula we obtain $-\frac{b}{2a} = \frac{\cdot 00105}{\cdot 00007}$ = 7·36 to which adding the initial time 1872·5, the time sought is found to be 1879·86 which differs little from the time of maximum easterly declination similarly found in paragraph 10. This seems to suggest that notwithstanding the later outbreak of independent increase of the horizontal force, the similar movements of increase and decrease of the two elements during those ten years, and perhaps before, may have had a common origin.

22. *Grubb's horizontal force magnetometer as an indicator of secular change.*—There is reason for believing that the magnet of the horizontal force magnetometer has acquired a condition in which its strength is so nearly constant* that the instrument may be reasonably expected to show with approximation changes of force that accumulate from year to year. The series of differences in column 12 of Table XI shows how much of secular variation there is in the annual values of the horizontal force given by the magnetometer in excess of the secular variation given by the annual mean determinations of absolute horizontal force as observed in the Electrometer Tower. The differences are curved in Figs. 17*a* and 17. Comparing this curve with that of Fig. 15 we see that it rises from 1874 to 1877 when the absolute force is increasing, also rises from 1879 to 1882 and again from 1884 to 1886 when the absolute force is decreasing, whilst it falls from 1882 to 1884 when the absolute force is increasing: from 1868 to 1872, from 1877 to 1879 and from 1886 to 1890 the ordinates of the curve change very little, and tell us thereby that the movements of the magnetometer were nearly in exact accordance with the changes of absolute force. There is also a general rise from beginning to end of the curve, which could be eliminated by adopting a smaller scale-coefficient for converting readings of the magnetometer into force; or by assuming that there had been a gradual growth in the strength of the magnet: these changes—both or either of them—would, however, still leave the unsymmetrical movements of the curve and Fig. 15 unexplained, and besides there is good reason for believing not only that the strength of the magnet has been steady but that the adopted scale-coefficient is very nearly accurate.†

23. And here again, as in the case of the declination magnetograph, it is difficult to conceive how the discrepancies can be due to instrumental irregularities, and not rather to real differences in the secular growth of the horizontal force in the Electrometer Tower and at the place of the horizontal force magnetometer. And although the discrepancies are too large to be disregarded, yet—as appears by a glance at Figs. 15 and 16—they are much outweighed by the general agreement of the magnetometer with the absolute determinations as indicated not only by similarity in the general course of the curves but also by reproduction in the magnetometer curve—although on a diminished scale—of the downward inflection that is so marked a secondary feature of the absolute force curve between 1879 and 1884.

24. *Annual variation.*—In Table XII are shown the means for each month, in the period 1863 to 1890, of the values of absolute horizontal force, corrected to the mean monthly reading of Grubb's horizontal force magnetometer: also the same means corrected

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* See Appendices to Bombay Magnetical and Meteorological Observations, 1879—82, page [152].

† The scale-coefficient was determined by means of deflection observations made upon Grubb's declination magnetometer and upon Grubb's horizontal force magnetometer with the same deflector magnet at distances of 2·0, 2·5 and 3·0 feet; and none of the three separate results differed from the adopted coefficient by so much as one per cent. of its value.

for secular change at the mean rate of +·0028 per annum; and the annual variation of the latter both in British units and in *m.m.—m.g.—s.* units. The range of the annual variation, it will be noticed, is very small, the greatest and least monthly inequalities being only +·0009 and —·0006 *m.m.—m.g.—s.* units of force. A semi-annual inequality is exhibited in which the horizontal force is, during the months March to August, on the average ·0003 greater than the mean of the year, and during the months September to February ·0003 less.

TABLE XII.

Month.		January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Year.
Mean horizontal force ...		8·0929	8·0932	8·0942	8·0949	8·0951	8·0966	8·0972	8·0956	8·0955	8·0955	8·0950	8·0950	...
Corrected for secular change.		8·0942	8·0943	8·0951	8·0955	8·0954	8·0967	8·0971	8·0952	8·0950	8·0947	8·0939	8·0937	8·0951
Annual variation in	British units ...	—·0009	—·0008	·0000	+·0004	+·0003	+·0016	+·0020	+·0001	—·0001	—·0004	—·0012	—·0014	...
	m.m.—m.g.—s. units.	—·0004	—·0004	·0000	+·0002	+·0002	+·0007	+·0009	·0000	·0000	—·0002	—·0006	—·0006	...

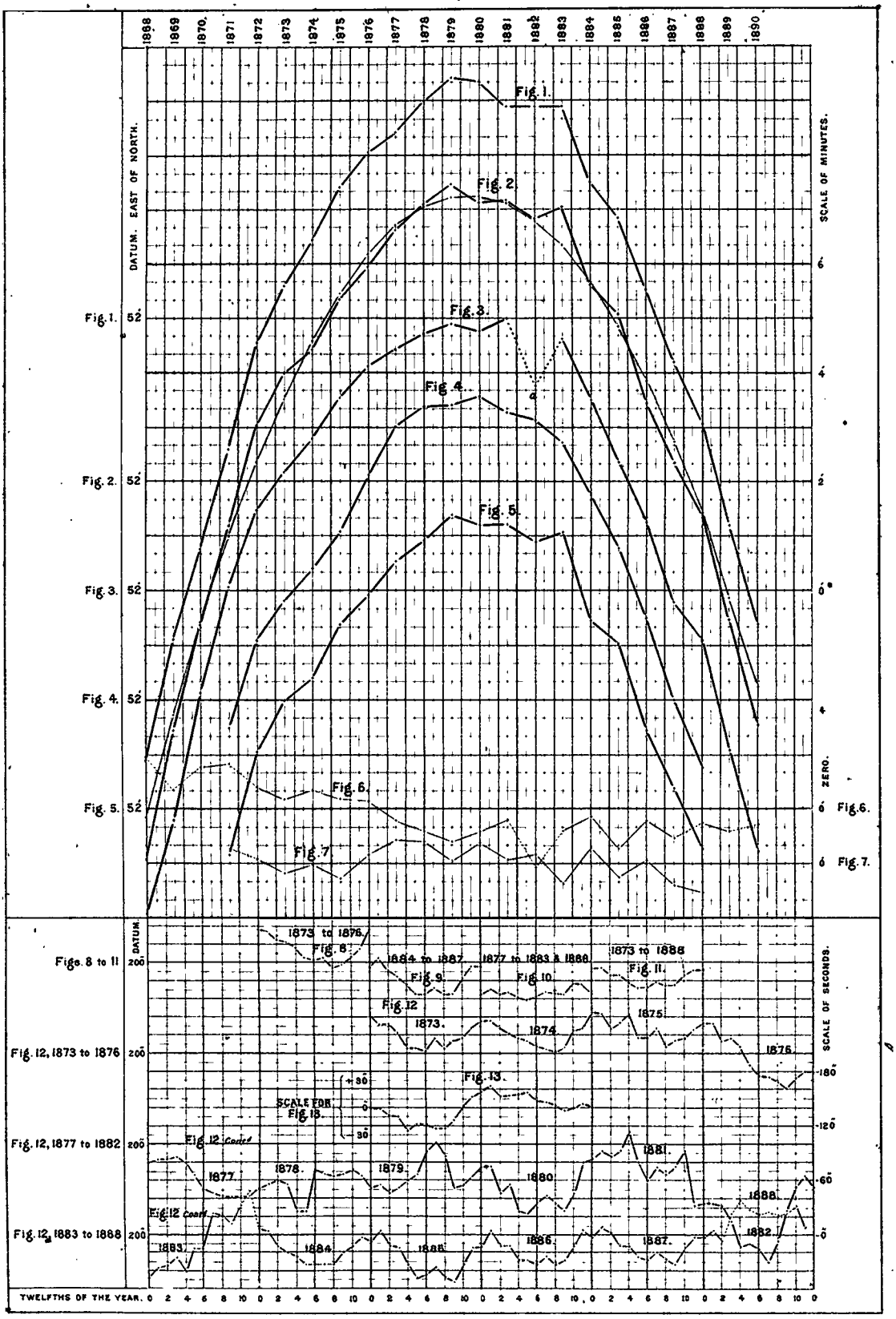
III.—SECULAR VARIATION OF THE RESULTANT FORCE IN THE HORIZONTAL PLANE.

25. To exhibit the secular variations of declination and horizontal force at one view the curve of Fig. 18 has been constructed. Its ordinates are the values of the absolute horizontal force given in Table XI, column 5, multiplied by the cosines of the arcs given in Table VII, column 2, and its abscissæ—shown in Table VII, column 10—are the values of the magnetic force in the true eastward direction, obtained by multiplying the sines of the arcs given in Table VII, column 2, by the absolute horizontal force of each year: the years, in order, are marked along the course of the curve. An interesting feature of this curve is that the points of the years 1872 to 1882 all lie approximately in a straight line, impyling that the resultant increments of force in the horizontal plane during that period had the constant direction N 19° 58′ E: the rate of increment along that line was about ·0027 during the first five years, then deminished to about ·0012 till 1879, and after 1880 became a decrement of the same amount.

COLABA OBSERVATORY.

SECULAR VARIATION OF DECLINATION.

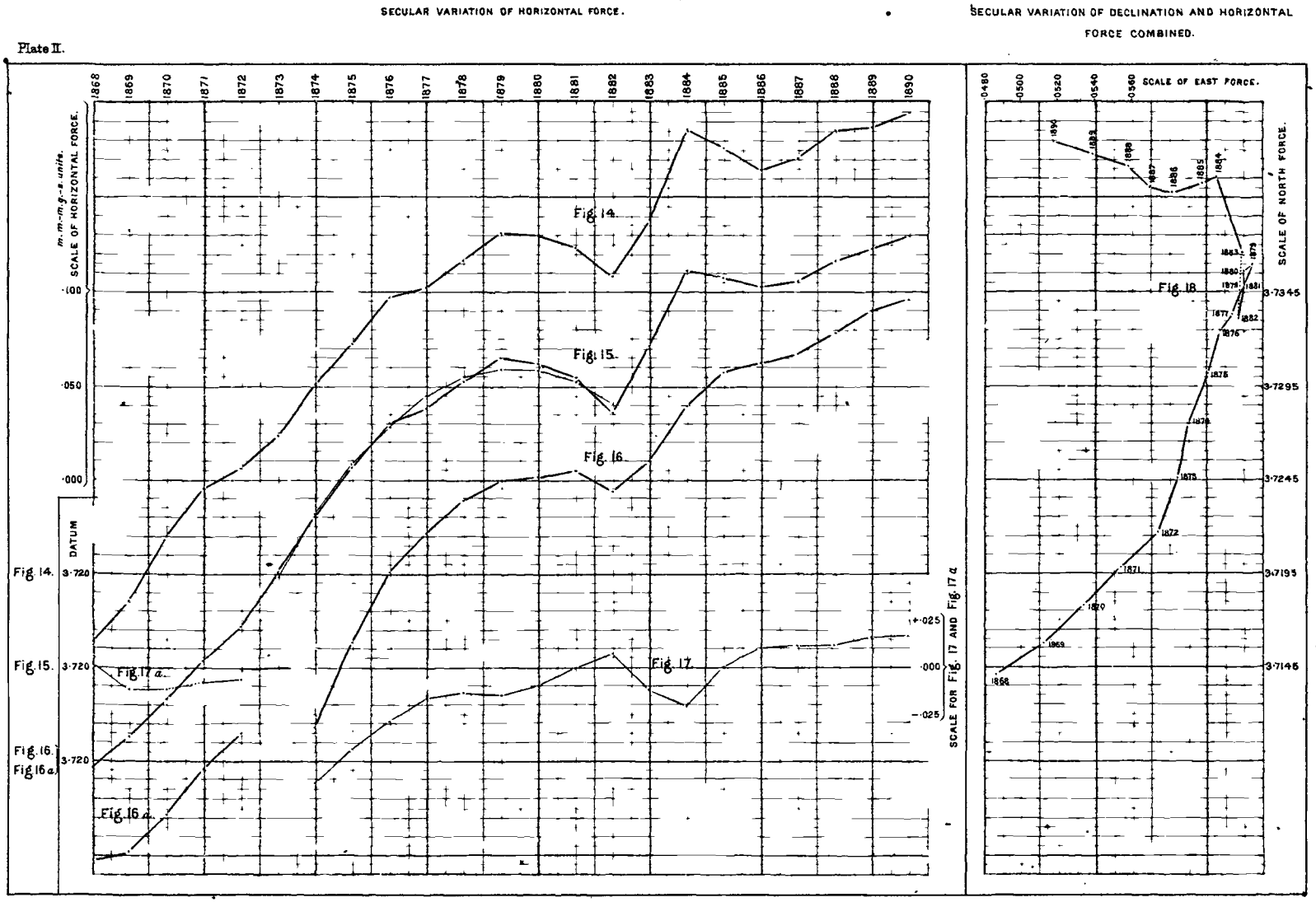
Plate I.



G. THE MEAN SCALE READING OF THE DECLINATION MAGNETOMETER FOR 1888 BEING SOMEWHAT DOUBTFUL (SEE PARAGRAPH 12) THE CURVE ON EACH SIDE OF THAT YEAR IS MADE IN DOTTED LINES.

COLABA OBSERVATORY.

Plate II.



MAGNETICAL AND METEOROLOGICAL OBSERVATIONS

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1891 AND 1892.

WITH AN APPENDIX.

133566

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UNDER THE DIRECTION OF

CHARLES CHAMBERS, Esq., F.R.S.,

AND

CHARLES CHAMBERS, JUNIOR, Esq., A.M.INST.C.E.

TOGETHER WITH AN APPENDIX CONTAINING AN ACCOUNT OF A MAGNETIC RESEARCH.

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TABLE OF CONTENTS.

PAGE

INTRODUCTION TO THE METEOROLOGICAL AND MAGNETICAL OBSERVATIONS, 1891 and 1892.

Thirty-first number of the series ... i.
Geographical position of Observatory ... id.
Local situation ... id.
Directorship of the Observatory ... id.
Observatory Establishment ... id.
System of observation and reduction and distribution of duties ... ii.
Eye-observations subsidiary to continuous registrations of automatic instruments ... iii.
Instruments and phenomena observed five times a day ... id.
Other routine operations ... iv.

REMARKS ON THE CONDITION AND ADJUSTMENTS OF THE INSTRUMENTS AND ON THE PROCESSES OF REDUCTION ... id.

I.—METEOROLOGICAL INSTRUMENTS, 1891 and 1892.

BAROMETER, description of ... id.
Error in setting the zero point of the scale, and change of method of observation ... v.
Corrections applied to the observed readings ... vi.
Comparison with the Kew Standard Barometer ... id.

GROUND THERMOMETERS ... vii.
THE ROBINSON-BECKLEY ANEMOGRAPH, description of... id.
Tabulation of Anemograms ... viii.
Method of reduction ... id.
NEWMAN'S RAIN GAUGE ... ix.
BAROGRAPH AND THERMOGRAPH ... x.

PRESSURE OF VAPOUR.

Pressure of Vapour and additional capacity of the Air ... id.
Table I.—Regnault's values of the Pressure of Vapour at different Temperatures ... id.

SELF-REGISTERING RAIN GAUGE ... xi.
New syphon of modified form ... id.
Constants for converting syphon discharges into inches of rain-fall ... id.
Measurement and distribution of syphon discharges ... id.
Determination of scale of rain-fall ordinates ... xii.

DESCRIPTION OF THE TABLES OF METEOROLOGICAL RESULTS AND OF THE PROCESSES OF REDUCTION, 1891 and 1892.

Barometric Pressure ... id.
Temperature of the Air, &c. ... id.
Monthly and annual range of variation of Meteorological Elements ... xiii.

NOTES ON INSTRUMENTAL CHANGES AND ON ALL IRREGULARITIES OR DEPARTURES FROM THE ROUTINE OF OBSERVATION OR REDUCTION, 1891 and 1892.

Robinson-Beckley Anemograph ... id.
Barograph ... xiv.
Thermograph dry-bulb ... id.
Thermograph wet-bulb ... id.
Self-registering Rain Gauge ... xv.

II.—MAGNETICAL INSTRUMENTS, 1891 and 1892.

Kew Absolute Declinometer and Deflection and Vibration Apparatus ... id.
Kew Dip Circle ... id.

Tables of Results derived from the Continuous Registrations of Automatic Meteorological Instruments and from Meteorological Observations, 1891 and 1892.

	1891.		1892.	
	Table.	Page.	Table.	Page.
Daily Means of: Barometric Pressure	I	2	IX	11
Daily Means of: Temperature of the Air	II	3	X	12
Daily Means of: Pressure of Vapour	III	4	XI	13
Daily Means of: Additional Capacity of the Air	IV	5	XII	14
Individual observations in each Month of the Year, which showed the greatest and the least values of the following elements, *viz.*, Height of Barometer, corrected for Temperature; Temperature of Air; Pressure of Vapour; and Additional Capacity of Air	XXI	24	XXII	24
Daily: Total Fall of Rain (in inches) as measured by F. Chambers's Self-registering Gauge, the funnel of which is 28 feet above the ground	V	6	XIII	15
Mean Velocities of the North or South and East or West Components of the Winds which blew on each Day of the Year	VI	7	XIV	16
Mean Velocity of the Wind, in miles per hour, without regard to the direction from which it blew for each day of Bombay Civil Time; also the Mean Monthly Velocity, and its Variation from the Mean of the Year	VII	8	XV	17
Sums of the Velocities, and the Mean Velocities, in miles per hour, of the Winds which blew in each Month, from each of the sixteen Principal Directions; and also the number of observations which those sums comprise; the latter numbers indicating the Relative Frequency of the same Wind (as to direction) in the several months, and of different Winds during the same month	VIII	9	XVI	18

Tables of Results derived from the Meteorological Observations made daily at 6, 10, 14, 16 and 22 hours, 1891 and 1892.

	1891.		1892.	
	Table.	Page.	Table.	Page.
Monthly Mean Temperature of the Ground, and its Annual Variation, at the respective depths of 1, 9, 20, 60 and 132 inches below the surface	XXIII	25	XXIV	25
Extent of Cloudy Sky—mean of estimations made at 6, 10, 14, 16 and 22 hours daily, the whole sky being reckoned as 10	XVII	20	XIX	22
Daily: Total Fall of Rain (in inches) as measured by Newman's Gauge, placed 4½ feet above the ground	XVIII	21	XX	23
Five-Day Means, 1891 and 1892	XXV	26	XXVI	27

Tables of Results of Absolute Magnetical Observations, 1891 and 1892.

	1891.		1892.	
	Table.	Page.	Table.	Page.
Observations of Vibration and Deflection, taken with the Kew Unifilar Magnetometer (No. 23, by Elliot Brothers), for the determination of Absolute Horizontal Force	I	(3)	IV	(13)
Observations of Absolute Declination	II	(6)	V	(16)
Observations of Inclination, taken with Barrow's Dip Circle, with Microscopes, No. 49 and two 3½-inch Needles	III	(7)	VI	(17)
Supplementary Observations of Inclination, taken with Barrow's Dip Circle, with Microscopes, No. 49 and two 3½-inch Needles	III *a*	(10)	VI*a*	(20)

Appendix.

INTRODUCTION

TO THE

METEOROLOGICAL AND MAGNETICAL OBSERVATIONS,

1891 AND 1892.

Of the series of books entitled "Bombay Magnetical and Meteorological Observations" the present one is the thirty-first, extending the record, which before embraced the years 1845 to 1890, up to 1892.

2. The latitude and longitude of the Colába Observatory are 18° 53′ 45″ North and 72° 48′ 56″ East respectively.

3. *Local situation.*—The Observatory is situated at the extremity of a narrow strip of land extending two miles to the south-westward of the Fort of Bombay and separating the harbour and Back Bay. Trap rock, which is very abundant in the ground near and on the surrounding sea-beach, crops up at many places through the red sandy soil which covers the greater part of the Observatory enclosure. During the rainy months of the year, the soil is overgrown with grass, which, however, is quickly burned up when the dry season comes round. The nearest elevated ground is Malabár Hill, which lies on the opposite side of Back Bay, at a distance of four miles, but that which subtends the largest vertical angle, as seen from the Magnetical and Meteorological Observatory, is the southern hill of the Island of Karanja, at a distance of about eight miles across the harbour. The altitude of the highest point of the latter is less than 1° 7′. An idea of the aspect and nature of the surrounding country, and of the exposure of the thermometer shed and anemograph, may be obtained by inspection of the photographs—forming a series of panoramic views all round the compass, together with some near views of the buildings and instruments—which accompanied the "Meteorology of the Bombay Presidency" published in 1878. In the same work will be found a plan of the grounds and buildings of the Observatory, and an index showing the names and uses of the several buildings, and the location of trees of large and small growth.

The buildings concerned with the production of the observations recorded herein are, (1) the Astronomical Observatory and the Anemometer Tower, with a western wing, the greater part of which serves as a computing room, whilst the remainder is partitioned off for a photographic operating room; (2) the Magnetical Observatory with the adjoining Electrometer Tower; (3) the underground Magnetograph room; and (4) the Thermograph Shed, enclosing the thermograph room; to which may be added the old thermometer shed.

4. *Directorship of the Observatory.*—The observations of the years 1891 and 1892 were taken under the direction of Mr. Charles Chambers, F.R.S., except during the period April 14 to June 27, 1891, when the acting Directorship was held by Mr. Charles Chambers, Junior, A. M. Inst. C.E.

5. *Observatory Establishment.*—In the Magnetical Department of the Observatory there are one First Assistant, one Second Assistant, three Observers and one Computer; and in the Astronomical Department one First Assistant and one Second Assistant. These several offices were filled, during the years 1891 and 1892, in the manner exhibited in the following statement:—

Name of Officer.	Department.	Name of Office.		Initial
Vinayak Narayan Nene ...	Magnetical ...	First Assistant ...	.....	V. N.
Krishnaji Ganesh Thakur...	Do. ...	Second Assistant .	Up to 11th August 1892	C.
Ganesh Sadashiv Joshi ...	Do. ...	Do. ...	After do.	G. S. J.
Do. do. ...	Do. ...	Observer	Up to 6th January 1892.	
Vithal Govind Ghanekar...	Do. ...	Do.	After do.	V. G. G.
Narayen Sakharam Kelkar	Do. ...	Do.	.....	N.
Damodar Waman Sathaye	Do. ...	Do.	Up to 11th August 1892	D.
Shitaram Vithal Benderkar	Do. ...	Do.	After do.	S.
Do. do. ...	Do. ...	Computer... ...	Up to do,	
Laxuman Balvant Chaphekar	Do. ...	Do.	After 15th September 1892	L.
Parsharam Laxuman Datar	Astronomical ...	First Assistant ...	.....	P.
Vithal Govind Ghanekar ...	Do. ...	Second Assistant .	Up to 6th January 1892.	
Ganesh Sadashiv Joshi ...	Do. ...	Do. ...	From 7th January to 11th August 1892.	
Damodar Waman Sathaye	Do. ...	Do. ...	After 11th August 1892.	

The initials marked in the last column are those which the respective observers attach to the several observations made by them.

Vacancies caused by the absence on leave of permanent employés were filled on different occasions by—

Bhalchandra Krishna Farge (Initial B.C.), and
Sadashiv Govind Joshi (Initial S.G.).

6. *System of observation and reduction and distribution of duties.*—The Astronomical Observatory is furnished with a transit instrument and a sidereal clock, which are used for the determination of local time, primarily for communication to the shipping in the Bombay harbour, and secondarily for communication, by comparison of chronometers three times a week, to the Magnetical and Meteorological Observatory.

Magnetical and meteorological observations are taken and entered in the registration forms every day, without exception, at the hours 6, 10, 14, 16 and 22,—the day commencing at midnight at Bombay (Colába) and being reckoned from 0^h to 24^h. One observer (called the morning observer) takes the 6^h observation, a second one (the day observer) those of 10^h, 14^h and 16^h, a third one (the night observer) that of 22^h, and a fourth is relieved from observing duty for one week; the next week the four observers—including the computer who takes regular observing duty—change round in circular order, and so on week by week. On Sundays and general holidays special arrangements are made to set free all but three members of the staff—one being kept on observing duty, one in charge of photographic instruments, and one in charge of the Astronomical Observatory. All the observers reside on the premises, and they are required to keep a general out-look on the weather during the intervals between their respective hours of observing duty and the next earlier observation hours. Each observer reduces his own observation immediately after the entry of the observation in the register, and the reductions are checked by the observer who next comes on duty: amongst the duties of the day observer are included the calculation of daily averages, and the writing out of the monthly abstracts. These latter consist of tables having the days of the month marked in numerical order in the first column and the hours of the day in order at the head of the columns, and there is one for each magnetical or meteorological element observed. Attendance in the computing room is exacted of the observers, when not actually engaged upon observing duty, as well as of the First Assistant, Magnetical Department, Second Assistant, Astronomical Department, and Computer, for six hours daily, exclusive of a break for rest in the middle of the day. Upon the First Assistant devolves the immediate oversight of general observing, computing and photographic operations. The observations of absolute declination, horizontal intensity, and dip, which are repeated once, twice and four times respectively every week, are distributed amongst the more experienced observers in such a manner that no two consecutive weeks' observations should, as a rule, fall to the same observer. The time of one Assistant

is almost entirely absorbed by the photographic operations, the instruments requiring vigilant attention, and the chemical processes demanding much skill and care.

The anemograph is in charge of the Second Assistant, Astronomical Department, who changes the recording paper daily, and tabulates the hourly readings of direction and movement of the wind. The tabulations are checked by the Photographer, between whom and the Second Assistant, Astronomical Department, are divided also the resolution of the tabulations into components and the writing out and checking of wind abstracts, the one performing a set of operations and the other checking them, and so on alternately. The correspondence of the direction record to the actual direction of the vane is frequently checked by turning the instrument to point to the Kennery Lighthouse, the azimuth of which is accurately known. In order to preserve the direction gear in smooth working condition, the fixed toothed wheel is cleaned and oiled—without stopping the instrument—once a week; and every day the direction vane is turned right round the compass once each way, with the object of lubricating both sides of the teeth of the wheel.

All computing operations are systematically performed by one computer and checked, by a repetition of the operation, by another.

7. The eye-observations that are taken five times a day are subsidiary to continuous registrations obtained by means of automatic recording instruments. Of these there are five sets of apparatus,

I. The magnetographs,
II. The barograph,
III. The thermograph,
IV. The pluviograph, and
V. The anemograph,

of which IV is an appendage of III, designed to work with the same light and to trace its curve on the same sheet of sensitive paper. The first four register photographically and the last mechanically.

8. *Instruments and phenomena observed five times a day.*—These are as follows:—

Extent and description of clouds, state of the weather, occasional phenomena, and direction of the wind. From 5 minutes before to 2 minutes after the exact hour.

Thermograph standard thermometer, dry bulb Do. do. wet bulb	At 2 minutes after the exact hour.
Newman's rain gauge (in wet season)... ...	„ 3 „ „
Thermometer in ground 1 inch deep... ... Do. do. 9 inches deep ...	From 5 to 7 „
Newman's standard barometer No. 58 and attached thermometer. Do. do. No. 48 ditto.	„ 7 to 9 „
Grubb's declination magnetometer	At 12 „ „
Grubb's horizontal force magnetometer and its thermometer	„ 14 „ „
Vertical force magnetograph and its thermometer...	„ 17 „ „
Declination magnetograph...	„ 18 „ „
Horizontal force magnetograph and its thermometer	„ 19 „ „
Thermometer attached to barograph ...	„ 20 „ „

The vacuum gauges of the magnetographs are read at 10 hours only, the maximum and minimum thermometers in the magnetograph room are read

and re-set at 10 hours only, and the 20 inches, 60 inches and 132 inches deep ground thermometers are read at 14 hours only.

Newman's rain gauge is read daily at midnight in the wet season, and the discharges of the syphon of the self-registering rain gauge are read once a day or oftener as required.

9. *Other routine operations.*—(1) The anemograph is supplied with fresh recording papers daily.

(2) Fresh sensitive papers are put upon the recording cylinders of the three magnetographs, of the barograph, and of the thermograph and pluviograph every two days. The papers taken off are developed, fixed and washed, and new ones are prepared by the photographer on alternate days.

(3) The tabulation of anemograms is effected as soon as the papers are available, generally, that is, on the day following that to which the record refers. Barograms, thermograms and declination, horizontal force and vertical force magnetograms also are regularly tabulated as soon as the registers are available.

(4) Double sets of observations of vibration and deflection are made with the unifilar magnetometer for the determination of the absolute horizontal force weekly, and with the same instrument observations of absolute declination are also made weekly.

Observations of magnetic dip are made four times a week.

The times of vibration of Grubb's declination and Grubb's horizontal force magnetometers are observed once a year; but each of the magnets is disturbed through a large arc (yet less than 1°) once a month, and the nearness of its return to the undisturbed position is recorded.

(5) Transit observations of stars for the determination of time are made generally on Mondays, Wednesdays and Fridays in the dry months: during the monsoon no opportunity is lost of observing the sun or stars when visible. The adjustment of the transit instrument is frequently tested by reference to the fixed collimator mark; the collimation, level, and azimuthal errors are determined from time to time, and whenever the collimator shows a displacement of the telescope, or any considerable discordances appear in the clock errors derived from observations of stars of different north polar distances.

Remarks on the Condition and Adjustments of the Instruments and on the Processes of Reduction.

10. The object of the following description is to make known such special circumstances in connection with the condition, situation and adjustment of the instruments, with the habits of the observers, and with the routine of the processes of reduction, as are necessary to enable the reader to form an independent judgment of the degree of precision attained, and of the weight to be attached to any conclusions that may be drawn from the observations.

I.—METEOROLOGICAL INSTRUMENTS, 1891 AND 1892.

BAROMETER.

11. *Description.*—The observations which furnished the fundamental data for the construction of the tables of barometric pressure for the years 1891 and 1892 were taken with a standard barometer by Newman, marked No. 58, the same which has been used uninterruptedly since the establishment of the Observatory. The internal diameter of the barometer tube, marked by the maker on the frame of the

instrument, is 0·530 inch. The scale, which is of brass, is moveable, and terminates below in an ivory point which is designed to be set, at each observation, so as just to touch the surface of the mercury in the cistern, and the setting is known to be accurate when the point appears just to meet its image reflected from the mercury. The upper part of the scale, which is divided to twentieths of an inch, has a vernier with slow motion screw, reading to thousandths of an inch, and to it are attached two small brass plates with horizontal lower edges before and behind the tube: the setting of the instrument consists in raising and lowering the vernier until the horizontal plane containing these two edges is tangent to the surface of the mercury in the tube of the barometer, and this is the case when it is just so low, and no lower, that when the eye is raised or lowered no light is seen to pass between the central part of the mercurial surface and the two edges. A thermometer with a cylindrical bulb dipping into the mercury in the cistern is attached to the barometer, and is intended to be read at every observation: but an investigation described in the "Bombay Magnetical and Meteorological Observations, 1871-78," Introduction, pages xlii to xlv, showed that the errors of this thermometer—as measuring the temperature of the mercurial column—were considerable, and since the end of 1884 its use has been discontinued: in lieu of it a thermometer by Murray and Heath (No. 2) divided to half degrees, and with its bulb immersed in a column of mercury held in a glass tube of nearly the same diameter as that of the barometer, was fixed on one side of the metal frame of the barometer at about the same height as the middle of the barometric column, and this has been regularly observed since 1885·0. The error of the new thermometer varies by about a quarter of a degree within the annual range of the temperature of the barometer No. 58, and in adopting a mean error throughout small pressure corrections of $\pm$ ·0003 are disregarded.

The standard barometer is attached by means of brackets to a flat board which hangs against the wall on the eastern side of the Magnetical Observatory, near the north-east corner of the room, and its cistern has an elevation of 37 feet above the mean sea level at Colába. It was lifted down in May 1866 and the mercury carefully caused to run up to the top of the tube, where it gave the sharp metallic stroke that is indicative of a good vacuum. It is stated in the "Report of the Committee of Physics of the Royal Society, 1840," page 56, where a description is given of a class of barometers of which this is an individual, that the scale is laid off from the zero point from an authentic standard. The tube of the barometer is kept in proper adjustment to verticality.

12. *Error in setting the zero point of the scale, and change of method of observation.*—In the long period that has elapsed since the instrument was mounted (in 1841) there has been a gradual accumulation of scum on the surface of the mercury in the cistern, and the glass cistern became more and more opaque until the reflected image of the ivory zero point of the scale was very obscurely seen, so that the operation of setting the zero of the scale was uncertain to a very sensible degree. For this reason, the method of observation which had always previously been in accordance with the above description, was changed on the 22nd May 1866, so as to avoid the necessity of setting the scale at every observation. The scale was set once for all on that day and the setting screw then removed; and suitable corrections were thereafter applied for the rise and fall of the mercury in the cistern. These were taken from a table calculated by the formula*

$$\text{Capacity correction} = \cdot 04321\ (h_0 - 29\cdot 943)$$

where h_0 represents the uncorrected reading of the barometer. As the departure of the barometer reading from its mean value very rarely reaches 0·4 inch,

* The data for the construction of this formula will be found in the "Bombay Magnetical and Meteorological Observations, 1865 - 70," Introduction, pp. x, xi.

which would require a correction of only ·017 inch, it is very improbable that an error of so much as ·001 inch ever occurs from inaccuracy in the adopted value of the relative capacities of the tube and cistern. Since the change was made, the comparability of the observations for showing variations is, therefore, throughout much better secured.

13. *Corrections applied to the observed readings.*—It was stated in the instructions given in the Report of the Committee of Physics (page 56) that the correction for capillary action in barometers of this description is rendered inappreciable by the large diameter of the tube, and consequently no correction for capillarity has ever been applied. Besides the correction for capacity, two others only have been applied; one, invariably from the first, for reducing the observations to what they would have been if the temperature of the mercury had always been 32° Fahr. and that of the brass scale 62° Fahr., and the other, since 1885·0, to remove the discontinuity that would otherwise have been produced in the records by the change of thermometers: the first was taken from Table II. of the Committee's Report, and the last was a constant reduction of the corrected pressure by ·002 inch. The considerations on which the latter correction was based are as follows: (1) the tabulations of the barograph are known to exhibit correctly the diurnal variations of barometric pressure, free from any sensible influence of variations of the temperature of that instrument;* (2) the mean of twenty-four hourly barograph tabulations on any day is taken to correspond to the mean of the same twenty-four hourly pressures observed with Newman's barometer No. 58 and corrected for the temperatures indicated by the old attached thermometer; (3) it does not follow that the mean of the tabulations for the five observation hours (6, 10, 14, 16 and 22) will then correspond exactly to the mean of the observed pressures for the same hours, because the old thermometer does not indicate precisely the actual variations of temperature of the mercurial column: in fact the latter mean pressure was, on the average of all the observation days of the year 1872, ·0008 inch in excess of the former mean pressure; (4) nevertheless the correspondence for the five observation hours was adopted as near enough to identity with the correspondence for the twenty-four hours, and the recorded mean pressures of the years 1873 to 1884 will thus be ·0008 inch in excess of those of the years before 1873; (5) the old attached thermometer and the thermometer No. 2 by Murray and Heath were read together at the five observation hours throughout the year 1883, and the average excess of the former reading over the latter was found to be 0°·62; (6) hence to make the pressures reduced for the readings of Murray and Heath No. 2 correspond to those reduced for the readings of the old thermometer the former pressures must be decreased by $·0027 \times 0·62 = ·0017$, or—as the pressures are read and calculated only to thousandths of an inch—by ·002 inch. Thus taking the period before 1873·0 as a standard period, the recorded annual mean pressures of the years 1873 to 1884 will be ·0008 inch too high, and those of 1885 and later years ·0005 inch [$= -·0020 + ·0017 + ·0008$] too high.

14. *Comparison with the Kew Standard Barometer.*—Indirect comparisons of Newman's barometer No. 58 with the Kew standard have been made through the mediation of two mountain barometers by Negretti and Zambra, numbered 705 and 711: in Bombay these were both found (in July 1876) to read ·011 inch higher than Newman No. 58, whilst in England they had been found to be ·007 and ·006 inch respectively above the Kew standard: hence Newman's No. 58 reads on the average ·004 inch below the Kew standard. It happens that this is exactly the average amount by which the readings of Newman's barometer have been over-reduced for temperature (*see* Introduction to volume for 1871 to 1878, paragraph 72).

*See "Bombay Magnetical and Meteorological Observations, 1871-78," Introduction, pages xxxvii to xlvi.

Ground Thermometers.

15. Thermometers with their bulbs at the respective depths below the surface of the ground of 1, 9, 20, 60, and 132 inches are regularly observed, the two former five times a day and the three latter once a day at 14 hours. They are all by Newman, of London, and are divided on brass scales, and the value of one division, approximate range of part of scale exposed above ground, and lengths of that part and of one average degree are shown below for each thermometer:—

Depth of Bulb.	Divided to	Approximate Range of exposed part of Scale.	Length of that Range.	Average length of 1°.
Inch.			Inches.	Inch.
1	1°	30° to 145°	8·19	·071
9	0°·2	70° to 115°	5·20	·116
20	1°	35° to 160°	6·73	·054
60	1°	35° to 160°	6·81	·054
132	1°	50° to 140°	6·44	·072

The 1-inch and 9-inch thermometers are on flat brass scale frames, which lie against wooden posts in the ground, and they have their bulbs in contact with the loose red earth which fills the holes in which they are placed; the 20-inch, 60-inch, and 132-inch thermometers have their lower parts enclosed in brass tubes with ends curving off to a point, and the upper parts are in wooden box frames, to which the brass scales are fixed. The reason why only one observation is made daily of the three deeper thermometers is, that it had been found by hourly observations in 1849, 1850 and 1851, that no appreciable diurnal variation of temperature reached the depth of 20 inches.

The errors of graduation of the ground thermometers are unknown.

The Robinson-Beckley Anemograph.

16. *Description.*—From the beginning of the month of June 1867 was brought into use an anemograph of the kind designed by Dr. Robinson, with improvements by Mr. Robert Beckley, and it remains in action to this day. It was made by Mr. R. W. Munro, and was supplied through the Kew Committee of the British Association, after being tested at the Kew Observatory. In this instrument the arrangements for the registration both of movement and direction of the wind are mounted on one shaft, and the registrations are made on a single sheet of paper, which is changed daily. The essential part of the apparatus for measuring the movement is a vertical spindle, to which cross arms are attached at the top, carrying four hemispherical cups of copper. The cups are attached to their several arms, so that, looking from the central axis, their convex sides are seen turned to the right hand, and the wind, acting with greater effect upon the concave than on the convex sides of the cups, causes the system to rotate in a right-handed direction. It is the number of these rotations, 140 of which are reckoned to a mile of movement of the wind, that tells us how fast the wind has been blowing; and the number is reduced, by means of wheelwork, 7,000 times before reaching a small cylinder, carrying a brass spiral pencil that traces the movement on the registering paper; this latter is metallic paper of the kind used for pocket-books, and is wrapped round a brass cylinder, which is kept rotating by clockwork, and as the paper passes under the spiral pencil, which presses slightly upon it, the black movement trace is received upon it. The wind vane, which consists of a pair of windmill vanes with connecting spindle having an endless screw in the middle, and gearing into a fixed horizontal toothed wheel, is attached to a tube that surrounds the lower part of the vertical movement spindle; to the bottom of the tube is fixed a toothed wheel, which, in communication with other such wheels, conveys the motion of the vane *unchanged* to a small cylinder with spiral pencil, which traces the changes of direction on the register;

and it is so arranged that the movement and direction are traced on parallel strips or bands of the same sheet of paper. The heavy parts of the instrument—the direction vane and appendages, and two long brass tubes which connect the instrument proper with the recording apparatus—are supported on friction balls which run in grooves partially filled with oil, thus reducing the friction to a minimum. The instrument is erected on the old Time Ball Tower, at a height of 53 feet above the ground, and 95 feet above the mean sea level, over a platform 12 feet in diameter, which is designed to give ready access to the instrument, and to protect it from irregular currents of wind, glancing from the convex surface of the dome; and it is supported outside by a fixed cast-iron standard, to which is attached, at the top, the toothed wheel, into which the endless screw of the spindle connecting the windmill vanes gears. The centres of each pair of opposite hemispherical cups are four feet apart, and three and a half feet above the platform, and the diameter of the cups is nine inches. The diameter of the vanes is 15 inches, and the breadth of the fans four inches. The register form is printed in red, with lines dividing its length into hour spaces; and its breadth, on the movement side, into five spaces, each representing 10 miles of movement of the wind, and numbered from 0 to 50 miles; and on the direction side into spaces corresponding to 11¼ degrees on each side of the 16 principal directions N.N.E., N.E., &c.....N.N.W., N., which spaces are numbered consecutively 1, 2, &c..... .15, 16.*

17. *Tabulation of Anemograms.*—Numerical tabulations have been made of the movement and direction of the wind during the interval between every two successive hours in the following manner:—the number of miles indicated at the point where the velocity trace cuts a horizontal hour-line being read for two successive hours, the excess of the latter over the former reading (adding 50 if the trace has passed over from left to right of the form) gives the movement for the interval; and the number of the space in which the direction trace lies during the interval is entered as representing the direction. The estimations of movement are made only to the nearest full mile. Should the direction trace not lie all in one space during the whole interval of an hour, then if the change of direction exceed 90° or eight points, the whole observation for that hourly interval is rejected; but if it lie within that limit, the direction is estimated—by an inspection of the movement and direction traces together—whence the aggregate flow of air was the greatest, and this direction is adopted for the full hour. On the average of the years 1871 to 1883, out of 8,754 hours during which the instrument was in action, 3 only had to be rejected, because the direction of the wind varied more than eight points within the hour.

18. *Method of reduction.*—Hitherto we have had to speak of phenomena liable only to simple increase and decrease of value, and not subject to any change of quality. Such phenomena being properly and completely evaluated by simple numbers, we may apply to the numbers any arithmetical operations, such as averaging, and infer from the results of those operations corresponding properties of the phenomena. But we have now come to a phenomenon which requires two numbers to express it, one representing its amount and the other a varying quality; the first referring to the velocity, and the last to the direction of the wind. Here we may no longer apply arithmetical processes directly and indiscriminately to the observed numbers: but, the subject being one of motion, we must treat them according to the principles of the science of motion. These principles tell us that the motions may be equally well expressed by means of two varying numbers referring to two invariable qualities, as by a varying number referring to a varying quality; and they show us how to obtain either form of expression from the other. The invariable qualities chosen in the present case are the directions north and east, the actual wind blowing in

* A more detailed account of the Colába anemograph will be found in the "Bombay Magnetical and Meteorological Observations, 1865 to 1870," Appendix I., page 199.

each hour being resolved into north and east components, which may be regarded separately as the velocity of the wind in the invariable direction north or south, and the velocity of the wind in the invariable direction east or west. The resolutions are effected by means of the formulæ :—

$$\text{North component of velocity of wind} = m \cos (n \times 22\tfrac{1}{2}^\circ),$$
$$\text{East component of velocity of wind} = m \sin (n \times 22\tfrac{1}{2}^\circ),$$

where m is the movement observed, and n the number of the direction space under which the wind of the hourly interval is classed. When the sign of either of these calculated quantities is negative, it implies that the wind blows from the opposite direction, *i. e.* from south or west. The calculations are readily made by means of tables to the nearest tenth of a mile of velocity per hour. Having now substituted the two equivalent winds for the real one, we may with propriety proceed to combine together numbers of observations by algebraical addition and averaging, treating the north and east components of the wind each by themselves. The averages thus found from the observations of any given period will represent the velocity with which the wind must blow from the northward (from the southward if the sign of the average be negative) continuously for the whole period, in order that the total movement of the wind from that direction may be the same as the total movement from the same direction produced by the winds which actually blow, and similarly the velocity with which it must blow continuously from the eastward (westward if the sign of the average be negative).

No corrections have been applied to the anemograph tabulations on account of friction.

Rain Gauge.

19. *Newman's Rain Gauge.*—This instrument is made of copper, and exposes for the collection of rain-drops a circular surface of an average diameter of 12·035 inches, forming the top of a funnel, that carries the rain into a cylindrical vessel below, having a diameter of 5·732 inches : a float of slightly less diameter, so as to rise and fall freely, rests upon the water in this vessel, and having a wholly convex external surface, it allows the rain as it falls to flow off and raise the level of the water and with it the float; to the middle of the float is fixed a wooden rod, graduated with divisions, each of which represents ·05 inch of rain; and the readings of this scale, which are easily estimated to fifths of a division, are made where it is cut by the upper edge of a light brass rod placed horizontally across the mouth of the funnel, but half an inch below the edge of the exposed circular surface; the scale passes through a hole in the middle of the horizontal rod, and is thus kept always in a vertical position. The range of the scale is from 0 to 4·00 inches, and the readings of the scale have been entered in the meteorological register and the differences been taken for every interval between successive observations: the rain has accumulated in the vessel generally till the reading was somewhere above 2·00 inches, when the water was let out, by means of a brass cock at the bottom, till the reading came down to 0·00 inch. This latter reading was also maintained during intervals of dry weather—when, from evaporation, the scale would otherwise have fallen lower—by pouring small quantities of water into the gauge : the reason of this is obvious, as, if some water were not always retained, the float would sometimes rest on the bottom of the vessel and so cease to perform its function of rising equally for equal increments of rain. The scale on the wooden rod was graduated so as to agree approximately with the data—the diameters of the gauge and measuring vessel—given above. The error of the scale according to which the rod was graduated was less than a thousandth of the whole.

Newman's gauge stands on a large rectangular block of stone, in a position intermediate between the Entrance Gate, the Magnetical Observatory, and the

Thermograph Shed, where the altitude of the highest neighbouring object, as seen from the gauge, is about 30°. It is supported by three feet, which are embedded with lead in holes cut in the stone block, and its circular mouth is at a height of 4½ feet above the ground and about 35 feet above the mean sea level.

Barograph and Thermograph.

20. Like the anemograph, the Colába barograph and thermograph were supplied through the Kew Committee of the British Association, after being tested at the Kew Observatory; and they are of like construction with those adopted by the Meteorological Committee of the Royal Society for the seven observatories established by them in the year 1867 in the United Kingdom. An account of these instruments in general, with notes on the peculiarities of the Colába set and on special points in the Colába arrangement of them and utilization of their registrations, will be found in the 1871—78 volume of this series, Introduction, pages xvi to xlvi.

21. *Thermograph.*—The height of the bulbs of the thermometers above the ground is 10 feet. The cage is placed on one of the most exposed parts of the Observatory grounds and away from any building: it is, however, screened, as well as the thermograph room in which the recording apparatus is placed, by a roomy shed with a planked roof that is everywhere 2 feet above the roofs of the cage and room: the sides of the shed are of the louvre construction on an enlarged scale, with double sheets of zinc enclosing a thick layer of felt substituted for the wooden laths, and with a vertical distance from lath to lath of one foot: the lowermost two feet of the sides are guarded simply by horizontal iron rods: the roof of the shed is covered with thick felt and then with strong canvas, and the whole of the exterior—sides and roof—is painted or limewashed white.

Pressure of Vapour.

22. *Pressure of Vapour and additional capacity of the Air.*—Having obtained from the tabulations of the barograms and thermograms hourly values of barometric pressure, temperature of the air, and temperature of evaporation, the pressure of vapour was calculated for each hour with the aid of a table by the formula

$$f''=f'-\cdot01147\ (t-t')\times\frac{P-f}{80}$$

in which t and t' denote the temperatures of the air and wet bulb thermometers respectively, f'' and f' the pressure of vapour at the temperature of the dew point and at temperature t', and P the barometric pressure. The values of the pressure of vapour at different temperatures were taken from the following table, the numbers in which have been extracted from Boileau's Collection of Tables:—

Table 1.—*Regnault's values of the Pressure of Vapour at different Temperatures.*

Temperature.	Pressure of vapour.	Temperature.	Pressure of vapour.	Temperature.	Pressure of vapour.	Temperature.	Pressure of vapour.	Temperature.	Pressure of vapour.	Temperature.	Pressure of vapour.	Temperature.	Pressure of vapour.	Temperature.	Pressure of vapour.
o	Inch.	o	Inch.	o	Inch.	o	Inch.	o	Inch.	o	Inch.	o	Inch.	o	Inch.
35	·204	43	·278	51	·374	59	·500	67	·662	75	·868	83	1·128	91	1·455
36	·212	44	·288	52	·388	60	·518	68	·685	76	·897	84	1·165	92	1·501
37	·220	45	·299	53	·403	61	·537	69	·709	77	·927	85	1·203	93	1·548
38	·229	46	·311	54	·418	62	·556	70	·733	78	·958	86	1·242	94	1·597
39	·238	47	·323	55	·433	63	·576	71	·758	79	·990	87	1·282	95	1·647
40	·248	48	·335	56	·449	64	·596	72	·784	80	1·023	88	1·324	96	1·698
41	·257	49	·348	57	·466	65	·617	73	·811	81	1·057	89	1·366	97	1·751
42	·267	50	·361	58	·482	66	·639	74	·839	82	1·092	90	1·410	98	1·805

To find the additional capacity of the air the pressure of vapour was deducted from the number in the above table standing opposite to the temperature of the air.

Self-registering Rain Gauge.

23. A description of this instrument also will be found in the Introduction to the "Bombay Magnetical and Meteorological Observations, 1871 to 1878," page xlvi. In 1891 and 1892 the syphon discharges were received in glass bottles and measured by means of a graduated glass tube and a marked glass bottle holding exactly half an inch of rain.

24. It was mentioned in former years that the occurrence of the discharging action of the syphon was occasionally liable to some uncertainty—the water at times trickling over the bend of the tube in considerable quantities before the proper discharge commenced. After trial of many modifications in the form of the syphon one was at last hit upon, which is free from this fault, and by which the tube is, moreover, kept in a satisfactorily clean condition from beginning to end of the monsoon, simply by the washing that takes place in the ordinary automatic discharges. Since November 1884, when the new syphon was brought into use, the discharges have been regular and unfailing except on two occasions, *viz.*, on the 18th June and 5th November 1890 when trickling again occurred: this was traced, in the last case, to the presence near the bend of the syphon tube of a living cockroach. To prevent this from occurring again, a lid of zinc was fitted to the discharge pipe at its entry into the receiving bottle, so as to cover the mouth of the bottle.

25. To prevent birds alighting upon the funnel, and choking it with their droppings, a conical arrangement of pointed iron spikes surrounding the funnel was attached in 1882, and was found to be effective.

26. *Constants for converting syphon discharges into inches of rainfall.*—As the surface exposed by the rain gauge funnel is 50·286 square inches, an inch of rain contains 823·955 cubic centimeters. With the aid of a cubic centimeter measure,* 412 cubic centimeters of water were poured into a narrow-necked glass bottle, and a file mark was made on the bottle neck at the level up to which the water rose. A glass tube was also graduated by means of the same cubic centimeter measure, so as to read off thousandths of an inch of rain with ease. The bottle is filled as often as there have been discharges from the rain gauge syphon, and the final excess or defect is measured with the graduated tube. The use of the bottle began on 31st July 1879 and continued till the 26th July 1884, when it was accidentally broken. An exact copy of it, which had been prepared beforehand, was then substituted for the original bottle, and this copy is still in use.

27. *Measurement and distribution of syphon discharges.*—The discharges are measured daily, or oftener during heavy rainfall, and are of course always of an integral number. For each measurement the average value of a discharge is attributed to each of the intervals of time, shown on the rain curve, between pairs of successive discharges; and it remains then only to distribute this quantity, for each filling of the receiving vessel, by means of tabulations of the ordinates of the rain curve. When, as is often the case, the rate of fall of the rain at the time of a discharge exceeds 1½ inch per hour, it is necessary to allow for the rain that enters the receiving vessel during the known time (16 seconds) of discharge, the allowance depending on the rate of rainfall, which is easily estimated for this purpose by noting, with the aid of an appropriate paper scale, the inclination of the rain curve immediately after the time of discharge. The aggregate of such allowances is deducted from a day's (or other) measurement before dividing the quantity equally amongst the several intervals.

* Lent by Mr. F. Chambers, whose verification data show it to be accurate to a thousandth of the 100 cubic centimeters which it is designed to measure.

28. *Determination of scale of rainfall ordinates.*—The factor for converting ordinates of the rainfall curve into inches of rainfall was found by experiments in which a determined weight or volume of distilled water was poured into the receiving vessel, and the change of length of the ordinate produced thereby was carefully measured. In an experiment made on the 25th May, 1891, the quantity of water poured into the vessel was equivalent to ·480 inch of rain, and the change of length of the ordinate ·4795 of a true inch; whence the factor is found to be 1·001, which is applicable to all the rainfall registrations of the year 1891. In a similar experiment made on the 23rd August, 1892, the quantity of water poured into the vessel was equivalent to ·480 inch of rain, and the change of length of the ordinate ·482 of a true inch; whence the factor is found to be ·996, which is applicable to all the rain-fall registrations of the year 1892.

On the 23rd July, 1891, the register in which the aggregate discharges of the syphon of the pluviograph are entered was accidentally burnt, and the record was lost for the first 23 days of July. The number of discharges during these 23 days—as shown by the pluviograms—was 41; and the average amount of a discharge derived from 26 discharges immediately before and 26 immediately after that period, having been ·507 inch in each case, this was adopted as the amount of rain that fell in the interval between each of the 41 discharges and the next preceding discharge.

29. The tabulations are made with the true-inch scale of the thermograph tabulating instrument, using the white line as datum; and the reading of this datum that shall correspond to the reading ·000 of the rain curve, when the receiving vessel has just been discharged, is re-determined whenever the adjustment of the recording apparatus is disturbed. For this purpose an average is taken of a number of measurements for all of which the rain is falling very slowly at the time of the syphon's coming into action and for a short time longer. It is necessary to select such occasions, because at times of heavy rainfall the curve has risen sensibly before the light has had time to make a distinct impression on the sensitive paper. The mode of tabulating is (1) to set the scale on the constant reading corresponding to the white line, (2) to move the sliding piece until the index is set upon the white line, and (3) to move the sliding bar till the index is set upon the curve, and then read the scale. By setting the paper carefully, so that a considerable length of the white line is practically parallel to the lateral motion of the frame, the repetition of the first two operations of tabulation is avoided until many hourly ordinates have been read; and then a new setting of the paper is made for another stretch of the white line.

Description of the Tables of Meteorological Results and of the Processes of Reduction, 1891 and 1892.

30. *Barometric Pressure.*—In Tables I and IX are shown, for every day in the year, the mean of 24 hourly tabulations of the barograph, corrected* to agree with Newman's barometer No. 58;—also the mean pressure for each month and each year, and the excess of each monthly mean above the annual mean for the same year; and the principal features of the annual variation are indicated at the foot of each of the tables. The maximum and minimum daily pressures in each month are distinguished by being printed in strong figures.

31. *Temperature of the Air, &c.*—The plan of the following tables is the same as that of Table I, but the subjects of them and the sources from which the numbers are obtained and the mode of obtaining them are as stated below:—

Tables II and X.—Temperature of the air: derived from hourly tabulations of the thermograph dry-bulb.

* In the manner described in paragraph 54 of the Introduction of the "Bombay Magnetical and Meteorological Observations for 1871 to 1878."

Tables III and XI.—Pressure of vapour: derived from hourly tabulations of the thermograph dry-bulb and wet-bulb, and of the barograph; and calculated in the manner described in paragraph 22.

Tables IV and XII.—Additional capacity of the air: derived from hourly differences between the pressure of vapour corresponding to the temperature of the air and the calculated actual pressure of vapour.

Tables VI and XIV.—Velocities of the north and east components of the wind: derived from hourly tabulations from the register of the Robinson-Beckley anemograph.

Tables VII and XV.—Velocity of the wind regardless of direction: derived from hourly tabulations from the register of the Robinson-Beckley anemograph.

Tables XVII and XIX.—Extent of cloudy sky: derived from estimations made at the hours 6, 10, 14, 16 and 22 daily.

32. Tables V, XIII, XVIII and XX are on the same plan as Table I, except that the entries made in them are aggregates—daily, monthly and yearly—instead of mean values; and they are sufficiently explained by their several headings.

33. *Monthly and annual range of variation of Meteorological Elements.*—Tables XXI and XXII show the extreme limits between which the oscillations of barometric pressure, temperature of the air, pressure of vapour, and additional capacity of the air were confined in each month and in the whole year, and also the ranges of the respective oscillations.

34. The numbers in Tables VIII and XVI are derived from hourly tabulations from the register of the Robinson-Beckley anemograph. The temperatures of the ground given in Tables XXIII and XXIV are derived from the readings of the several thermometers, made five times a day as regards the 1 inch and 9 inches deep thermometers, and once a day as regards the 20 inches, 60 inches and 132 inches deep thermometers. The five-day means of Tables XXV and XXVI are derived from hourly tabulations of the barograph (combined with readings of Newman's barometer No. 58) and thermograph, from the measurements in Newman's rain-gauge, and from hourly tabulations from the register of the Robinson-Beckley anemograph. In other respects these tables require no explanation beyond their titles, the headings of the several columns, and the footnotes.

Notes on instrumental changes and on all irregularities or departures from the routine of observation or reduction, 1891 and 1892.

35. *Robinson-Beckley Anemograph.*—One of the two clips that fasten the paper to the cylinder got loose on February 11, 1891. External parts painted on May 26, 1891, and January 12, May 17 and December 3, 1892. Owing to stoppage of clock on December 27, 1891. Instrument dismounted and cleaned on March 21, 1892. Clock taken to pieces for cleaning on March 22, 1892. The aggregate of all the interruptions of the instrument in the years 1891 and 1892 was $1^d\ 1^h\ 21^m$: the loss of record was, however, rarely complete, and values partly or entirely interpolated have been inserted whenever the interruption was not somewhat prolonged. To aid in the making of interpolations, it has been customary, whenever the action of the instrument was voluntarily interrupted for more than one hour, to observe the direction of the wind by estimation, and to record the readings of a small auxiliary velocity measurer put up for the occasion. No complete day's records have been omitted in the formation of monthly abstracts.

36. When for any reason the traces furnished by the photographic self-registering instruments are interrupted, and the interruption includes the moments when one or more hourly tabulations should be made, these last are either substituted by the corresponding eye-observations, if the hours should happen to be any of the five regular observation hours, or if special eye-observations were taken for the purpose, or else, if no eye-observations are available,

they are interpolated. In the last case, if the interruption lasts for less time than one hour, the interpolation is made on the assumption that the rate of change of the phenomenon from its value at the beginning to its value at the end of the interruption was uniform, providing that the parts of the curve immediately preceding and immediately following the gap were, in appearance, continuations of the straight line connecting the extremities of the gap. If the last condition is not satisfied, or if the gap, taking account of points inserted by means of eye-observations, is of greater length than one hour, the interpolation is made between the next preceding and the next following hourly entries, first, by allowing for the known *normal* rate of change of the phenomenon between those hours in the same month, and then by assuming that any additional change, shown by the difference between the values of the phenomenon at the two extreme hours, has grown at a uniform rate. Interpolated values are entered in the abstract sheets with enclosing square brackets—inserted eye-observations between parentheses.

37. *Barograph.*—No tabulations were obtained for the following hours for the several reasons stated, but eye-observations were available and were adopted for the hours marked within parentheses, and for the rest interpolation had to be resorted to:—

(1) Clock being taken to pieces for cleaning: for 1892 March 17^d (10^h) to (17^h).

(2) Owing to stain on photographic paper: for 1892 July 18^d 23^h.

Occasional, though rare, failure of the bihourly stops to act has caused no loss of record.

The aggregate of all the interruptions of the barograph in the years 1891 and 1892 was 9^h 31^m*, and the number of hourly tabulations lost was 9, but of these 8 were substituted by eye-observations, leaving only 1 to be interpolated.

38. *Thermograph dry-bulb.*—No tabulations were obtained for the following hours for the several reasons stated, but eye-observations were available, and were adopted for the hours marked within parentheses, and for the rest interpolation had to be resorted to:—

(1) Clock being taken to pieces for cleaning: for 1892 March 19^d (10^h) to (16^h).

(2) Owing to stoppage of clock: for 1892 November 12^d 7^h.

Occasional, though rare, failure of the bihourly stops to act has caused no loss of record.

The aggregate of all the interruptions of the thermograph dry-bulb in the years 1891 and 1892 was 8^h 24^m; the number of hourly tabulations lost was 8, but of these 7 were substituted by eye-observations, leaving only 1 to be interpolated.

39. *Thermograph wet-bulb.*—No tabulations were obtained for the following hours for the several reasons stated, but eye-observations were available and were adopted for the hours marked within parentheses, and for the rest interpolation had to be resorted to:—

(1) Clock being taken to pieces for cleaning: for 1892 March 19^d (10^h) to (16^h).

(2) Owing to stoppage of clock: for 1892 November 12^d 7^h.

Occasional, though rare, failure of the bihourly stops to act has caused no loss of record.

The aggregate of all the interruptions of the thermograph wet-bulb in the years 1891 and 1892 was 26^h 17^m, made up chiefly of short intervals of time occupied in cleaning and renewing the muslin coverings of the bulbs and the

* If not unusually prolonged, the short interruptions caused by the regular changing of photographic papers and by changing of lamps are not included in the above aggregate, nor in the aggregates of interruptions of the thermograph that follow further on.

bundles of threads connecting them with the supply of water. The number of hourly tabulations lost was 8, but of these 7 were substituted by eye-observations, leaving only 1 to be interpolated.

40. *Self-registering Rain-gauge.*—There was no loss of hourly tabulations in the years 1891 and 1892.

II.—MAGNETICAL INSTRUMENTS, 1891 AND 1892.

Kew Absolute Declinometer and Deflection and Vibration Apparatus.

41. A description of this instrument, with which the observations of absolute declination and of horizontal intensity for the years 1891 and 1892 have been taken, will be found on pages xxxiii to liii of the Introduction to the "Bombay Magnetical and Meteorological Observations, 1865—70"; the description includes also an account of the situation of the instrument, of the nature and routine of the observations taken with it—with examples of observation and computation forms filled up with the figures of actual observations—and of the formulæ of reduction and the constants involved in them.

1891, August 5.—The vertical spider line in the deflection telescope was found broken and a new one was inserted. Observations deferred till August 6.

42. The entries in columns 1 to 17 and 19 of the Tables of Observations of Absolute Horizontal Force are copied directly from the computation form: column 18 is given to show the degree of accordance existing in the determinations from deflections with the deflecting magnet at the respective distances 0·8 foot and 1·0 foot from the deflected magnet; and the numbers in column 21 are the products of those in column 20 multiplied by the constant number ·46108.

43. The description, referred to above, of the observation of absolute declination will render clear the meaning of the numbers entered in each column of the Tables of Observations of Absolute Declination: all of these, except the monthly means in columns 12 and 13, are taken directly from the observation form.

Kew Dip Circle.

44. A description of this instrument, and of the mode of using it, is also given in the Introduction to the "Bombay Magnetical and Meteorological Observations, 1865—70," pages lvi to lix, and the following additional or corrective remarks will make it applicable to the observations of 1891 and 1892:—

(1) The place of observation has been the top room of the Electrometer Tower, the dip circle having been placed on the same pillar on which the Kew unifilar magnetometer is placed in the regular observations of absolute horizontal force and absolute declination. The reading of the azimuth circle adopted for this place has invariably been 63° 31′. An observation for the verification of this reading was made on the 22nd February 1881.

(2) The dip needles used during the years 1891 and 1892 have been as follows:—

For the regular observations:—
Dover, Charlton No. 1.
" " No. 2.
And for supplementary observations:—
John Dover No. $\frac{1}{81}$.
" " No. $\frac{2}{81}$.

(3) The final cleaning of the axles of the needles has throughout been made with a clean silk cloth.

CHARLES CHAMBERS,
Director.

Colaba Observatory, July 1893.

TABLES OF RESULTS

DERIVED

FROM THE CONTINUOUS REGISTRATIONS OF AUTOMATIC METEOROLOGICAL INSTRUMENTS

AND FROM

METEOROLOGICAL OBSERVATIONS,

1891 AND 1892.

TABLES OF RESULTS

DERIVED FROM THE

ETEOROLOGICAL OBSERVATIONS MADE DAIL AT 6, 10, 14, 16 AND 22 HOURS,

1891 AND 1892.

FIVE-DAY MEANS,

1891 AND 1892.

B 260—1 B

TABLE I.—Barometric Pressure, 1891.

Height of Barometer above mean Sea-level = 37 feet.

1891. Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
1	29·988	**29·874**	29·866	29·803	29·816	**29·802**	29·566	29·720	**29·675**	29·868	29·921	29·971
2	**30·035**	·894	·872	·826	**·856**	·791	·535	·721	·720	·908	·881	·971
3	·021	·922	·870	·815	·841	·751	·584	·686	·744	·885	·862	·975
4	29·968	·891	·887	·808	·823	·753	·635	·694	·761	·844	·834	·967
5	·968	·912	·874	·834	·837	·743	·620	·692	·782	·844	·796	·935
6	·979	·927	·855	·833	·830	·756	·650	·668	·798	·873	**·785**	·943
7	·974	·951	·894	·840	·824	·800	·715	**·661**	·814	·892	·791	·974
8	·953	·985	**·911**	·836	·793	·769	**·745**	·678	·780	·874	·861	·970
9	·936	·981	·898	·863	·773	·742	·722	·733	·775	8·56	·907	·947
10	·938	·942	·859	**·905**	·774	·736	·713	·750	·773	·849	·913	·946
11	·947	·963	·846	·899	·771	·727	·708	·780	·822	.842	·924	·951
12	·950	·987	·861	·851	·749	·730	·716	·791	·833	·867	·876	·972
13	·958	**·989**	·896	·816	·756	·759	·701	·778	·840	·866	·836	·949
14	·967	·981	·906	·833	·765	·782	·642	·766	**·860**	·838	·837	·936
15	·948	·931	·863	·825	·821	·798	·649	·780	·837	·826	·897	·934
16	·925	·935	·827	·813	·802	·745	·680	**·821**	·788	·852	·948	·914
17	·966	·983	·841	**·791**	·790	·706	·737	·814	·764	·856	·927	·924
18	·999	·989	·870	·854	·806	·734	·726	·777	·734	·860	·904	·933
19	·976	·918	·884	·846	·814	·755	·635	·774	·731	·863	·902	·969
20	·953	·887	·867	·841	·735	·763	·581	·798	·805	·845	·898	·974
21	·923	·930	.858	·812	·713	·714	·620	·801	·849	·818	·895	·961
22	·906	·915	·874	·851	·694	·707	·609	·758	·846	**·794**	·897	·930
23	·947	·964	·868	·848	·720	·710	·593	·747	·802	·810	·920	·960
24	·963	·968	·849	·833	·698	·697	·624	·779	·793	·843	·928	30·036
25	·939	·926	·857	·820	·683	·706	·641	·774	·779	·820	·941	**·045**
26	·937	·907	·882	·814	**·667**	·738	·587	·744	·754	·842	·973	·005
27	·945	·931	·897	·828	·703	·744	**·522**	·729	·778	·908	·980	29·986
28	·908	·910	·862	·835	·751	·670	·607	·762	·823	·916	·962	·980
29	**·878**		·838	·839	·709	·605	·714	·787	·845	·875	·963	·960
30	·902		·822	·835	·685	**·598**	·744	·757	·842	·858	**·985**	·942
31	·908		**·807**		·749		·719	·695		**·928**		**·913**
Monthly Mean.	29·952	29·939	29·866	29·835	29·766	29·734	**29·653**	29·749	29·792	29·859	29·898	**29·960**
Annual Variation	+·118	+·105	+·032	+·001	—·068	—·100	—·181	—·085	—·042	+·025	+·064	+·126

	in.
Annual mean	29·834
The greatest mean daily barometric pressure in the year (that of 25th December) was	30·045.
The least do. do. do. (that of 27th July) was	29·522
Difference =	0·523.

TABLE II.—Temperature of the Air, 1891.

1891. Date.	MONTH. January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	°	°	°	°	°	°	°	°	°	°	°	°
1	75·5	76·1	77·9	79·0	82·6	85·5	80·1	80·9	**77·4**	80·5	83·0	78·2
2	75·1	74·4	**79·5**	**78·6**	**82·2**	85·6	80·8	80·7	77·7	80·6	81·4	77·7
3	75·4	69·5	79·1	78·8	82·3	85·9	80·0	80·1	77·9	80·4	82·1	77·4
4	74·5	68·9	78·8	80·2	82·5	86·2	80·9	79·7	78·2	80·6	80·6	76·8
5	74·6	71·4	77·5	80·7	82·4	86·3	80·5	80·1	80·1	80·5	80·1	76·4
6	74·9	70·1	77·6	79·8	82·9	86·7	82·4	80·7	79·5	**80·1**	80·3	76·9
7	74·9	69·0	76·8	79·6	82·5	**86·8**	82·2	80·2	80·6	82·0	82·5	77·2
8	73·9	**67·3**	76·2	81·4	82·4	86·0	82·2	80·0	78·1	81·7	82·3	76·6
9	73·1	68·0	77·3	80·9	82·6	86·2	82·5	**79·3**	79·7	82·7	82·1	77·0
10	72·5	69·8	77·5	80·4	82·7	86·0	83·2	80·7	79·2	82·7	**83·2**	76·7
11	72·9	72·3	77·1	79·9	82·8	86·2	83·5	80·1	81·0	82·1	81·4	75·8
12	74·4	73·1	76·3	79·9	83·0	85·8	**83·7**	80·2	80·8	82·4	80·1	75·6
13	75·7	72·5	74·4	80·8	83·4	85·7	82·6	80·2	**81·4**	81·7	78·6	76·7
14	77·3	73·5	**74·1**	80·5	82·9	86·0	83·0	80·8	81·3	81·1	78·6	77·5
15	76·4	74·6	75·3	80·9	83·4	85·9	83·7	80·9	81·1	81·3	79·6	75·7
16	75·9	74·9	77·4	82·1	83·8	86·0	82·2	81·2	79·5	81·5	80·7	**74·4**
17	73·0	74·9	78·1	**84·3**	84·3	85·9	79·9	81·2	79·8	80·6	79·1	75·2
18	**70·3**	76·0	79·1	82·3	84·2	86·0	**77·7**	80·8	78·7	80·9	78·0	75·2
19	72·2	77·1	79·3	82·4	84·0	86·1	79·1	80·6	78·7	81·2	78·0	76·1
20	72·1	75·7	77·8	82·0	84·2	86·5	79·8	79·5	80·6	81·6	77·9	77·0
21	71·5	74·6	77·2	81·4	84·5	85·2	77·7	80·3	80·7	81·2	77·6	76·9
22	71·6	75·3	77·8	81·3	84·5	85·1	79·8	80·9	80·9	80·7	77·2	77·1
23	72·6	75·2	77·5	81·3	85·1	83·6	78·4	81·0	80·5	80·8	76·6	78·8
24	71·4	75·2	77·4	81·7	84·5	84·6	79·3	80·9	79·8	81·0	75·7	**79·6**
25	70·8	76·1	78·0	81·5	84·3	82·9	80·2	**81·4**	79·5	81·5	**75·6**	77·5
26	73·0	76·9	79·5	81·3	84·6	83·7	78·7	80·6	81·3	**83·0**	76·5	77·2
27	75·1	**77·7**	79·1	82·4	85·1	83·6	77·8	79·8	79·8	82·8	77·6	75·9
28	75·7	76·9	79·0	82·3	85·2	**79·1**	79·8	79·8	79·2	82·4	77·8	76·5
29	76·9		78·9	82·0	85·2	79·2	80·5	80·8	79·3	81·4	77·9	76·6
30	**77·5**		79·0	81·9	85·3	80·0	80·3	80·9	81·0	80·8	78·3	76·4
31	77·3		79·4		**85·6**		80·9	79·9		82·9		74·9
Monthly Mean.	74·1	**73·5**	77·7	81·1	83·7	**84·9**	80·8	80·5	79·8	81·4	79·3	76·7
Annual Variation ...	—5·4	—6·0	—1·8	+1·6	+4·2	+5·4	+1·3	+1·0	+0·3	+1·9	—0·2	−2·8

	°
Annual mean	79·5
The greatest mean daily temperature of the air in the year (that of 7th June) was	86·8
The least do. do. do. (that of 8th February) was	67·3
Difference =	19·5

TABLE III.—Pressure of Vapour, 1891.

1891. Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
1	0·591	0·626	0·725	**0·695**	0·828	0·910	0·899	0·889	0·876	0·870	0·796	0·665
2	·571	·649	·685	·709	·834	·896	·898	·885	·868	·861	·672	·641
3	·540	·485	·703	·732	·874	·925	·905	·890	·878	·830	·664	·660
4	·568	·396	·659	·764	·880	·931	·918	·887	·864	·852	·619	·622
5	·573	·422	·701	·765	·863	·933	·924	·891	·870	·848	·587	·732
6	·588	·376	·721	·736	·809	·963	·936	**·895**	·861	·862	·616	·625
7	·606	·359	·649	·781	·822	·966	·940	·885	·852	**·912**	·699	·614
8	·606	**·309**	·655	·704	·873	**·970**	·928	·874	·831	·846	·881	·595
9	·591	·347	·681	·795	·878	·947	·933	·854	**·817**	·859	**·912**	·577
10	·495	·425	·630	·857	·866	·952	**·946**	·892	·838	·824	·838	·544
11	·536	·537	·668	·822	·889	·963	·941	·883	·840	·755	·752	·506
12	·605	·592	·625	·823	**·915**	·947	·920	·857	·853	·785	·710	**·487**
13	·622	·578	**·533**	·851	·915	·923	·908	**·833**	·845	·770	·684	·611
14	·637	·516	·546	·852	·894	·900	·912	·850	·849	·784	·660	·595
15	·638	·516	·568	·838	·865	·896	·908	·868	·834	·795	·662	·566
16	**·667**	·657	·598	·853	·866	·872	·894	·876	·846	·758	·632	·580
17	·591	·649	·595	·789	·894	**·849**	·883	·866	·850	·778	·649	·602
18	**·440**	·594	·602	·866	·879	·865	·884	·875	·863	·774	·607	·591
19	·492	·591	·623	·798	·869	·893	·894	·866	·866	·803	·608	·592
20	·528	·611	·650	·843	·890	·925	·880	·849	·845	·789	·593	·597
21	·515	·686	·624	·830	·902	·939	**·864**	·857	·834	·772	·583	·607
22	·533	·705	·596	·817	·866	·947	·891	·861	·855	·755	·554	·637
23	·592	·691	·607	·823	·898	·943	·878	·869	·869	·762	**·537**	**·696**
24	·462	·664	·699	·839	**·789**	·924	·902	·878	·895	·788	·558	·659
25	·503	·606	·687	·845	·852	·934	·888	·870	·918	·837	·589	·595
26	·545	·591	·621	·853	·888	·903	·870	·868	**·934**	·859	·621	·522
27	·586	·694	·665	·859	·907	·902	·872	·864	·894	·882	·620	·537
28	·629	**·732**	·639	**·879**	·900	·899	·892	·878	·875	·888	·643	·532
29	·601		·717	·844	·881	·887	·905	·893	·869	·789	·665	·519
30	·580		**·728**	·834	·874	·876	·893	·876	·870	**·718**	·635	·528
31	·587		·690		·890		·905	·877		·837		·526
Monthly Mean...	**0·568**	0·557	0·648	0·810	0·873	**0·919**	0·904	0·873	0·862	0·814	0·662	0·589
Annual Variation ...	—·189	—·200	—·109	+·053	+·116	+·162	+·147	+·116	+·105	+·057	—·095	—·168

	in.
Annual mean	0·757
The greatest mean daily pressure of vapour in the year (that of 8th June) was	0·970
The least do. do. do. (that of 8th February) was ...	0·309
Difference =	0·661

TABLE IV.—Additional Capacity of the Air, 1891.

1891. Date.	MONTH.											
	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
1	0·298	0·278	0·233	0·298	0·290	0·317	0·127	0.165	**0·064**	0·174	0·338	0·309
2	·308	·205	·326	·274	·267	·332	·154	·163	·082	·187	·413	·319
3	·352	·238	·293	·258	·233	·316	·118	·135	·080	·208	·437	·286
4	·294	·320	·329	·272	·232	·321	·137	**·129**	·102	·194	·431	·316
5	·290	·355	·248	·285	·247	·323	·117	·137	·163	·196	**·446**	·286
6	·287	·365	**231**	·282	·321	·308	·171	·153	·147	**·167**	·422	·306
7	·268	·353	·277	·234	·294	·309	·161	·144	·192	·191	·417	·327
8	·236	**·366**	·252	·374	·239	·275	·173	·151	·130	·240	·222	·328
9	·228	·346	·261	·260	·240	·305	·178	·147	·198	·264	**·188**	·359
10	·309	·310	·319	**·183**	·256	·293	·190	·156	·162	·302	·305	·384
11	·279	·261	·265	·201	·236	·288	·208	·144	·219	**·346**	·326	·393
12	·253	·232	·283	·201	**·217**	·291	·234	·173	·199	·326	·323	·407
13	·272	·224	·318	·203	·229	·316	·207	·199	·228	·318	·298	·315
14	·307	·314	·298	·192	·234	·343	·217	·201	·223	·282	·323	·358
15	·276	·346	·315	·217	·282	·347	**·247**	·186	**·229**	·280	·356	·331
16	·231	·215	·346	·245	·293	·372	·209	·188	·165	·324	·424	·282
17	·221	·221	·374	**·393**	·285	**·393**	·140	·200	·169	·273	·352	**·281**
18	·309	·311	**·398**	·243	·295	·382	**·064**	·177	·118	·287	·360	·290
19	·303	·347	·380	·315	·300	·356	·099	·181	·116	·266	·355	·314
20	·264	·283	·306	·253	·284	·339	·140	·160	·200	·294	·369	·347
21	·262	**·173**	·317	·245	·285	·276	·087	·177	·216	·297	·372	·322
22	·245	·174	·364	·255	·320	·262	·127	·195	·201	·298	·387	·298
23	**·212**	·185	·341	·248	·314	·211	·093	·191	·173	·294	·385	·290
24	·311	·215	·245	·246	**·397**	·265	·098	·177	·125	·274	·339	·355
25	·261	·302	·276	·232	·325	·192	·144	**·202**	·099	·244	·303	·353
26	·277	·340	·392	·221	·304	·251	·113	·175	·134	·278	·298	**·419**
27	·292	·260	·331	·250	·302	·252	·079	·152	·125	·241	·334	·364
28	·268	·196	·355	·228	·313	**·096**	·125	·140	·127	·229	·316	·390
29	·333		·272	·250	·330	·112	·136	·160	·135	·292	·300	·405
30	**·373**		·267	·260	·343	·143	·141	·178	·190	·340	·344	·392
31	·361		·320		·337		·148	·143		·292		·356
Monthly Mean.	0·283	0·276	0·308	0·254	0·285	0·286	**0·148**	0·167	0·157	0·264	**0·349**	0·338
Annual Variation ..	+·023	+·016	+·048	—·006	+·025	+·026	—·112	—·093	—·103	+·004	+·089	+·078

	in.
Annual mean	0·260
The greatest mean daily additional capacity of the air in the year (that of 5th November) was	0·446
The least do. do. do. (that of 18th July) was ...	0·064
Difference =	0·382

Rainfall, 1891.

TABLE V.—*Total Fall of Rain (in inches) as measured by F. Chambers's Self-registering Gauge, the funnel of which is 28 feet above the ground.*

1891.	MONTH.											
Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
			in.			in.	in.	in.	in.	in.		
1							0·30	0·03	5·75			
2							0·93	0·02	2·05			
3							1·51	0·43	0·97			
4							0·57	1·43	0·57			
5							3·88	0·12	0·22	0·29		
6							0·30		0·59			
7						0·09	0·28	0·07	0·11	0·47		
8						0·17	1·23	0·04	2·77			
9							0·10	0·18	0·19			
10						0·06	0·04	0·10	0·18			
11								0·12				
12			0·18			0·01		0·16				
13								0·04	0·03			
14							0·01	0·01	0·01			
15							0·01		0·14			
16							0·94	0·08	0·20			
17							0·58	0·11	0·30			
18							5·19	0·12	0·75			
19							0·99	0·21	1·45			
20							0·70	0·46				
21						0·98	1·73	0·75				
22						0·59	0·09	0·06	0·04			
23						2·87	1·48	0·02	0·10			
24						0·01	1·84	0·11	1·56			
25						0·20	1·12		2·24			
26						0·02	3·31	0·09	0·17			
27						1·02	4·24	0·34	0·50			
28						4·72	0·36	0·78	1·02			
29						2·57	0·01	0·43				
30						0·24	0·12	0·24	0·15			
31							0·02	0·26				
Monthly Total.			0·18			13.55	31·88	6·81	22·06	0·76		
Number of rainy days.			1			14	28	28	25	2		

Total fall of rain in the year ... ... 75·24 inches.
Total number of rainy days in the year 98
The greatest daily fall of rain in the year (that of 1st September) was ... ... 5·75 inches.
No rain fell in the months of January, February, April, May, November and December, nor on any of the days left blank in the above table.

Mean Daily Velocities of the North and East Components of the Wind, 1891.

TABLE VI.—*Showing the Mean Velocities of the North or South and East or West Components of the Winds which blew on each day of the year 1891*

In Miles per Hour.

1891. Date.	MONTH.																							
	January.		February.		March.		April.		May.		June.		July.		August.		September.		October.		November.		December.	
	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.
1 ...	6·1 N	1·6 E	3·5 N	0·8 W	8·4 N	5·7 W	9·9N	7·3 W	10·7 N	7·8 W	1·6 N	9·9 W	16·0 S	1·4 E	7·4 S	15·9 W	1·4 S	2·9 W	1·6 N	1·4W	5·4 N	0·2 W	5·9 N	2·8 E
2 ...	2·6 N	1·6 E	8·0 N	1·7 W	12·2 N	5·8 W	8·0 N	6·1 W	10·9 N	8·8 W	3·2 N	10·8 W	7·7 S	10·8 W	7·9 S	17·0 W	1·8 S	3·9 W	4·9 N	0·9 W	6·6 N	5·1E	5·7 N	2·2 E
3 ...	5·7 N	3·6 E	15·5 N	4·7 W	10·4 N	6·6 W	10·7 N	6·9 W	10·7 N	7·9 W	3·0 N	12·1 W	7·4 S	15·9 W	7·9 S	19·0 W	8·7 S	0·4 W	6·9 N	1·6 W	9·1 N	5·6 E	4·9 N	0·4 E
4 ...	5·5 N	1·9 E	13·3 N	2·3 W	10·0 N	6·5 W	8·6 N	5·5 W	5·1 N	7·6 W	0·2 S	11·5 W	8·3 S	19·3 W	6·8 S	19·6 W	7·9 S	2·9 W	4·9 N	0·3 W	7·0 N	2·3 E	5·3 N	2·3 E
5 ...	4·3 N	2·0 E	14·9 N	2·0 W	3·0 N	3·7 W	8·6 N	6·9 W	6·1 N	6·3 W	1·7 S	11·8 W	9·1 S	22·3 W	7·6 S	16·6 W	6·6 S	7·7 W	5·4 N	3·2 E	8·8 N	3·2 E	5·8 N	0·1 E
6 ...	2·1 N	2·2 E	16·4 N	4·0 W	1·9 N	5·3 W	7·6 N	7·5 W	8·7 N	7·4 W	2·8 S	12·4 W	7·2 S	17·3 W	9·0 S	12·9 W	5·1 S	10·0 W	0·2 N	1·3 E	9·9 N	1·5 E	4·6 N	0·9 E
7 ...	2·9 N	0·5 E	18·7 N	4·9 W	6·4 N	5·9 W	8·8 N	7·5 W	6·9 N	4·8 W	2·9 S	11·4 W	7·7 S	17·5 W	8·9 S	14·8 W	4·4 S	14·7 W	0·7 N	2·0 E	7·9 N	2·3 E	5·5 N	1·6 E
8 ...	5·3 N	0·4 E	19·6 N	4·3 W	0·2 N	4·4 W	14·3 N	6·2 W	5·1 N	8·5 W	2·8 S	12·9 W	6·4 S	18·8 W	7·6 S	20·2 W	2·4 S	18·2 W	6·3 N	3·0 E	1·1 S	1·8 W	7·7 N	5·4 E
9 ...	8·7 N	0·7 W	14·4 N	2·9 W	2·5 N	4·3 W	3·0 N	5·1 W	7·6 N	8·4 W	6·3 S	15·3 W	5·9 S	17·9 W	0·8 S	15·1 W	3·7 S	14·5 W	6·1 N	2·2 E	0·3 N	1·7 W	8·7 N	6·0 E
10 ...	10·1 N	0·1 E	11·7 N	3·1 W	5·6 N	3·7 W	3·9 S	5·3 W	8·3 N	10·8 W	4·0 S	16·1 W	2·3 S	16·7 W	2·0 S	11·5 W	0·4 N	8·3 W	6·1 N	4·6 E	4·1 N	0·2 W	9·7 N	6·6 E
11 ...	10·0 N	2·2 W	8·2 N	0·5 W	0·9 N	3·8 W	0·9 N	6·3 W	7·3 N	8·5 W	1·2 S	15·3 W	0·0	14·9 W	2·5 S	15·1 W	0·3 S	12·6 W	8·1 N	2·7 E	5·4 N	0·3 E	9·2 N	6·5 E
12 ...	2·8 N	1·0 E	8·1 N	2·1 W	0·9 N	13·3 W	6·7 N	7·3 W	5·9 N	9·5 W	0·1 S	13·2 W	2·2 S	12·5 W	4·6 S	18·5 W	3·1 S	7·2 W	5·6 N	2·2 E	5·0 N	0·4 W	6·6 N	7·0 E
13 ...	1·8 N	0·9 E	11·7 N	5·5 W	3·3 N	5·9 W	6·4 N	5·9 W	2·5 N	10·0 W	0·6 S	11·4 W	3·5 S	6·2 W	7·0 S	20·4 W	0·8 S	12·3 W	6·2 N	1·2 W	3·7 N	0·5 W	8·8 N	3·0 E
14 ...	3·5 N	1·9 E	12·9 N	3·2 W	7·3 N	4·8 W	1·0 N	7·2 W	5·8 N	9·9 W	0·7 S	9·4 W	2·6 S	8·1 W	6·0 S	15·4 W	0·2 S	12·0 W	6·1 N	0·5 E	4·4 N	0·9 E	8·0 N	3·9 E
15 ...	0·4 N	0·8 E	10·0 N	1·3 W	12·8 N	4·3 W	9·9 N	7·0 W	6·7 N	10·1 W	1·0 N	6·9 W	6·7 S	19·0 W	6·7 S	16·2 W	4·5 S	10·7 W	5·4 N	0·9 E	5·6 N	3·6 E	6·3 N	1·7 E
16 ...	0·9 S	1·0 W	1·0 N	1·6 W	16·7 N	5·5 W	8·5 N	3·9 W	7·5 N	8·9 W	3·2 N	8·8 W	5·4 S	16·5 W	2·8 S	15·2 W	3·6 S	7·8 W	5·5 N	1·5 E	7·6 N	5·6 E	3·3 N	1·5 E
17 ...	12·9 N	3·0 W	4·8 N	0·8 W	15·3 N	7·7 W	4·6 N	3·9 W	4·4 N	9·4 W	5·1 N	9·4 W	2·6 S	15·2 W	1·0 S	15·0 W	4·6 S	8·4 W	5·8 N	2·1 E	5·3 N	2·8 E	4·8 N	1·6 E
18 ...	15·3 N	3·0 W	9·4 N	2·4 W	16·6 N	5·6 W	0·9 N	6·1 W	6·3 N	10·2 W	4·5 N	8·6 W	2·6 S	13·0 W	0·7 S	15·0 W	2·7 S	5·9 W	6·1 N	4·3 E	6·9 N	1·5 E	4·9 N	3·5 E
19 ...	12·2 N	1·9 W	7·6 N	2·3W	8·8 N	5·9 W	8·5 N	5·8 W	5·6 N	8·2 W	2·4 N	8·0 W	3·0 N	8·9 W	0·0	17·5 W	0·3 N	10·1 W	7·8 N	3·0 E	7·6 N	1·6 E	6·1 N	2·8 E
20 ...	8·8 N	2·6 W	5·5 N	4·4 W	10·0 N	7·5 W	3·8 N	8·5 W	6·8 N	8·8 W	0·4 N	7·9 W	1·6 N	14·2 W	2·0 N	13·1 W	5·5 S	8·9 W	7·3 N	2·9 E	5·5 N	1·1 E	7·1 N	3·1 E
21 ...	7·1 N	3·0 W	3·3 N	3·1 W	10·9 N	4·8 W	3·3 N	7·2 W	3·1 N	9·7 W	3·8 S	5·7 W	4·3 S	3·7 W	1·5 S	12·9 W	4·9 S	5·5 W	7·3 N	3·8 E	4·8 N	2·9 E	7·6 N	0·4 E
22 ...	2·9 N	1·2 E	1·3 S	1·3 W	14·4 N	7·5 W	1·7 S	6·0 W	2·8 N	9·6 W	7·6 S	4·3 W	3·3 S	15·0 W	1·1 N	13·2 W	1·5 S	7·1 W	4·6 N	1·6 E	7·2 N	2·5 E	6·6 N	1·8 E
23 ...	6·9 N	0·8 E	7·7 N	1·9 W	7·7 N	6·8 W	0·9 N	7·1 W	2·8 S	9·4 W	8·8 S	1·3 W	6·9 S	17·3 W	0·1 S	9·6 W	0·4 S	5·5 W	4·1 N	0·7 E	6·6 N	1·3 E	2·8 N	2·8 E
24 ...	15·2 N	1·6 W	10·3 N	4·3 W	1·2 N	5·4 W	2·1 S	6·2 W	0·8 S	9·7 W	21·8 S	0·2 E	7·2 S	20·4 W	0·7 N	6·8 W	0·3 S	0·9 W	3·4 N	0·7 E	5·0 N	2·4 E	5·6 N	1·2 E
25 ...	9·4 N	1·6 W	5·5 N	2·8 W	4·8 N	6·4 W	0·1 N	5·8 W	1·4 S	6·2 W	13·4 S	2·6 W	8·4 S	20·2 W	0·3 S	11·6 W	3·5 N	10·3 W	4·4 N	1·7 W	5·8 N	1·6 E	6·4 N	2·0 E
26 ...	8·9 N	0·0	5·9 N	0·1 E	12·0 N	4·5 W	0·0	6·4 W	1·5 S	6·7 W	7·2 S	7·2 W	7·4 S	25·5 W	0·0	17·6 W	6·7 N	16·3 W	1·8 S	0·5 E	4·1 N	1·6 E	8·0 N	4·5 E
27 ...	6·6 N	0·4 E	3·7 N	2·5 W	15·4 N	9·8 W	1·4 S	6·8 W	3·3 S	8·3 W	3·6 S	12·0 W	7·0 S	31·8 W	3·8 S	19·2 W	1·1 S	8·6 W	0·7 N	0·2 W	5·2 N	1·3 E	7·7 N	3·8 E
28 ...	7·2 N	2·2 W	2·3 N	3·5 W	14·5 N	4·2 W	2·4 N	5·4 W	0·8 S	9·4 W	6·4 S	6·1 W	8·2 S	27·9 W	3·6 S	13·7 W	0·1 S	3·6 W	6·0 N	1·5 W	5·4 N	1·3 E	6·9 N	6·8 E
29 ...	8·6 N	3·1 E			8·8 N	7·6 W	6·0 N	6·9 W	2·0 S	10·0 W	14·2 S	5·3 W	7·2 S	14·6 W	0·2 N	12·7 W	1·2 S	1·5 W	6·7 N	1·6 W	6·0 N	1·3 E	7·8 N	6·2 E
30 ...	2·9 N	2·2 E			8·1 N	7·4 W	8·3 N	8·4 W	3·0 S	9·4 W	10·3 S	6·6 W	7·0 S	16·5 W	0·0	12·1 W	4·5 N	8·1 W	3·9 N	0·2 E	6·8 N	1·7 E	7·4 N	5·8 E
31 ...	3·2 N	1·9 E			10·4 N	6·4 W			1·7 S	9·1 W			6·3 S	16·0 W	1·7 N	14·0 W			0·1 N	2·2 E			5·8 N	0·8 E
Monthly Mean ...	6·4 N	0·2 E	9·0 N	2·6 W	8·4 N	6·0 W	4·8 N	6·4 W	4·1 N	8·7 W	3·2 S	9·1 W	5·6 S	15·9 W	3·3 S	15·1 W	2·0 S	8·2 W	4·7 N	1·1 E	5·7 N	1·7 E	6·5 N	3·2 E
Annual Variation ...	3·4 N	5·7 E	6·0 N	2·9 E	5·4 N	0·5 W	1·8 N	0·9 W	1·1 N	3·2 W	6·2 S	3·6 W	8·6 S	10·4 W	6·3 S	9·6 W	5·0 S	2·7 W	1·7 N	6·6 E	2·7 N	7·2 E	3·5 N	8·7 E

The Velocities of the Mean Components for the year are 3·0 N. and 5·5 W.

Velocity of Wind, 1891.

TABLE VII.—*Mean Velocity of the Wind, in miles per hour, without regard to the direction from which it blew, for each Day of Bombay Civil Time: also the Mean Monthly Velocity, and its Variation from the Mean of the year.*

1891. Date.	MONTH. January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	Miles	Miles	Miles	Miles	Miles	Miles	Miles	Miles	Miles	Miles	Miles	Miles
1	10·7	9·0	10·7	13·3	**14·9**	10·2	17·8	17·7	9·5	8·0	10·7	10·8
2	8·4	10·0	14·4	12·0	14·4	11·4	14·1	18·9	8·7	9·3	14·2	9·6
3	10·2	17·3	13·6	13·7	14·1	12·7	18·1	20·6	11·1	10·0	**15·4**	8·2
4	9·8	14·2	13·2	12·3	11·0	11·5	21.2	21·1	11·2	9·4	12·2	9·7
5	8·4	16·2	7·8	13·1	9·5	12·2	24·4	18·4	10·5	9·9	13·2	8·8
6	7·0	17·3	8·7	11·9	12·0	12·9	18·7	16·1	11·8	**5·7**	13·7	8·5
7	**6·8**	19·7	9·5	12·1	9·4	12·0	19·2	17·6	15·6	10·5	13·2	9·8
8	8·6	**20·5**	**6·7**	**16·8**	10·4	13·5	20·0	21·7	**19·0**	11·5	6·7	13·4
9	11·6	15·7	9·5	7·9	12·9	16·5	19·1	15·7	15·5	9·1	**6·1**	14·7
10	12·2	12·9	9·0	8·7	14·7	16·9	17·3	12·0	12·2	10·3	7·8	**15·1**
11	11·8	10·8	7·5	9·6	12·9	15·5	14·9	15·6	12·7	**15·0**	9·1	15·0
12	6·8	10·3	14·1	11·9	11·4	13·3	13·0	19·5	9·7	11·3	9·4	14·5
13	7·7	13·4	8·2	9·8	11·7	11·5	**7·7**	**21·8**	12·5	9·0	7·7	13·7
14	9·0	13·6	12·7	8·3	11·8	9·5	9·4	16·6	12·1	9·5	8·7	12·0
15	7·5	11·7	15·2	13·2	12·3	**7·2**	20·3	17·5	11·7	9·4	10·6	9·2
16	7·5	6·0	18·0	12·1	12·3	9·4	17·5	15·7	9·2	9·1	13·2	**6·5**
17	**16·9**	7·1	17·9	9·4	10·4	10·8	16·8	15·2	10·0	9·5	9·8	8·7
18	16·2	10.8	18·0	8·2	12·2	10·0	15·6	15·3	9·0	11·4	10·2	9·7
19	13·5	10·4	12·1	11·7	11·5	8·5	13·1	17·5	11·6	12·8	12·4	9·8
20	10·5	7·8	12·9	9·8	12·6	8·0	15·7	13·6	10·7	11·5	9·5	10·7
21	8·7	6·0	13·9	8·7	10·4	8·4	8·6	13·5	8·7	14·1	10·8	10·3
22	7·5	**5·2**	17·1	9·8	10·5	10·6	15·7	13·5	7·4	8·5	11·6	9·9
23	11·2	12·2	11·4	8·4	10·0	11·6	18·7	9·7	8·5	9·5	11·0	8·1
24	16·8	12·1	8·3	7·8	9·9	**23·5**	21·8	**8·4**	**6·9**	8·2	10·2	9·1
25	10·7	8·0	11·2	**6·2**	**6·6**	16·6	21·9	11·7	12·8	7·2	9·6	10·7
26	10·8	8·7	14·5	6·6	7·2	12·5	27·0	17·6	17·8	6·1	8·0	12·5
27	10·2	6·6	**18·8**	7·6	9·8	13·2	**33·2**	20·0	13·5	8·1	9·0	12·1
28	9·1	6·2	15·7	8·2	9·6	10·7	29·6	14·7	10·0	8·8	10·0	13·6
29	13·5		12·4	10·1	10·4	17·0	16·5	12·7	10·7	8·9	9·2	13·6
30	8·0		11·3	13·5	10·0	14·3	18·0	12·1	9·7	6·7	10·7	12·4
31	8·0		13·0		9·4		17·2	14·6		8·3		9·5
Monthly Mean	10·2	11·4	12·5	10·4	11·2	12·4	**18·1**	16·0	11·3	**9·6**	10·5	11·0
Annual Variation	—1·8	—0·6	+0·5	—1·6	—0·8	+0·4	+6·1	+ 4·9	—0·7	—2·4	—1·5	—1·0

	Miles.
The Mean Velocity for June to August	15·5
The Mean Velocity for September to May	10·9
The Mean Velocity for the year	12·0
The greatest monthly mean (that of July)	18·1
The least monthly mean (that of October)	9·6
Difference = ...	8·5

The greatest mean daily Velocity of Wind in the year (that of 27th July) was ... ... 33·2
The least do. do. do. (that of 22nd February) was ... 5·2

Difference = ... 28·0

Aggregate and Mean Velocities and Relative Frequency of Different Winds, 1891.

TABLE VIII.—*Showing, for the year 1891, the sums of the Velocities, and the Mean Velocities, in miles per hour, of the Winds which blew, in each Month, from each of the sixteen Principal Directions: and also the number of hourly Observations which those sums comprise; the latter numbers indicating the Relative frequency of the same Wind (as to direction) in the several Months, and of different Winds during the same Month.*

1891.	N.			N.N.E.			N.E.			E.N.E.			E.			E.S.E.			S.E.			S.S.E.		
Month.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.
	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.
January ...	866	105	8·2	490	67	7·3	384	52	7·4	1,420	153	9·3	331	44	7·5	193	26	7·4	50	7	7·1	15	3	5·0
February ...	1,270	118	10·8	472	62	7·6	189	30	6·3	433	64	6·8	49	11	4·5	56	8	7·0	41	9	4·6	31	6	5·2
March ...	871	89	9·8	321	47	6·8	137	25	5·5	128	17	7·5	52	9	5·8	43	10	4·3	26	5	5·2	33	6	5·5
April ...	332	50	6·6	193	32	6·0	127	22	5·8	41	8	5·1	30	6	5·0	16	4	4·0	34	7	5·0	64	10	6·4
May ...	152	26	5·8	131	23	5·7	34	6	5·7	29	5	5·8	9	2	4·5	0	0	0·0	6	1	6·0	0	0	0·0
June... ...	10	1	10·0	0	0	0·0	7	1	7.0	0	0	0·0	0	0	0·0	31	3	10·3	115	13	8·8	418	25	16·7
July ...	8	2	4·0	21	2	10·5	14	2	7·0	7	1	7·0	0	0	0·0	11	1	11·0	29	2	14·5	274	20	13·7
August ...	0	0	0·0	0	0	0·0	0	0	0·0	0	0	0·0	0	0	0·0	6	1	6·0	12	2	6·0	0	0	0·0
September ...	29	5	5·8	37	4	9·2	32	4	8·0	29	4	7·2	47	6	7·8	243	24	10·1	144	17	8·5	225	22	10·2
October ...	346	52	6·7	161	26	6·2	403	58	6·9	1,828	192	9·5	651	70	9·3	251	28	9·0	52	7	7·4	80	5	16·0
November ...	385	53	7·3	214	31	6·9	593	75	7·9	2,559	244	10·6	313	35	8·9	90	12	7·5	0	0	0·0	63	9	7·0
December ...	460	53	8·7	331	58	5·7	579	73	7·9	2,372	269	12.5	303	32	9·5	81	10	8·1	0	0	0·0	0	0	0·0
Year ...	4,729	554	8·5	2,371	352	6·7	2,499	348	7·2	9,846	954	10·3	1,785	215	8·3	1,021	127	8·0	509	70	7·3	1,203	106	11·3

1891.	S.			S.S.W.			S.W.			W.S.W.			W.			W.N.W.			N.W.			N.N.W.			No. of Observations.		No. of hours.
Month.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Calm	Variable.	Record lost.
	Miles.		Miles.	Miles.		Miles.	Miles		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.			
January ...	0	0	0·0	0	0	0·0	4	1	4·0	52	8	6·5	248	30	8·3	577	50	11·5	911	78	11·7	2,033	120	16·9	0	0	0
February ...	0	0	0·0	0	0	0·0	4	1	4·0	28	6	4·7	103	13	7·9	418	49	8·5	1,113	95	11·7	3,474	199	17·5	1	0	0
March ...	32	7	4·6	61	8	7·6	41	8	5·1	147	15	9·8	302	30	10·1	1,100	94	11·7	3,525	232	15·2	2,479	142	17·5	0	0	0
April ...	82	13	6·3	138	14	9·9	150	30	5·0	378	50	7·6	706	71	9·9	1,792	140	12·8	2,284	173	13·2	1,144	85	13·5	5	0	0
May ...	9	2	4·5	55	6	9·2	129	19	6·8	811	91	8·9	1,292	130	9·9	2,783	198	14·1	2,313	183	12·6	556	52	10·7	0	0	0
June ...	576	28	20·6	742	44	16·9	528	47	11·2	2,140	160	13·4	2,902	253	11·5	1,308	127	10·3	155	18	8·6	0	0	0·0	0	0	0
July ...	113	6	18·8	204	14	14·6	636	57	11·2	8,751	449	19·5	3,037	163	18·6	320	21	15·2	19	1	19·0	54	3	18·0	0	0	0
August ...	0	0	0·0	9	1	9·0	543	34	16·0	5,842	327	17·9	4,918	336	14·6	548	38	14·4	42	5	8·4	0	0	0·0	0	0	0
September ...	279	27	10·3	245	25	9·8	573	66	8·7	2,309	198	11·7	2,486	205	12·1	1,351	98	13·8	87	9	9·7	53	6	8·8	0	0	0
October ...	25	4	6·2	0	0	0·0	0	0	0·0	66	13	5·1	158	19	8·3	561	54	10·4	1,230	114	10·8	1,309	102	12·8	0	0	0
November ...	57	6	9·5	0	0	0·0	7	1	7·0	11	3	3·7	46	7	6·6	758	68	11·1	1,147	90	12·7	1,301	89	14·6	0	0	0
December ...	0	0	0·0	0	0	0·0	0	0	0·0	0	0	0·0	63	8	7·9	338	38	8·9	801	77	10·4	1,844	126	14·6	0	0	0
Year ...	1,173	93	12·6	1,454	112	13·0	2,615	264	9·9	20,535	1,320	15·6	16,261	1,265	12·9	11,854	975	12·2	13,627	1,075	12·7	14,247	924	15·4	6	0	0

Table IX.—Barometric Pressure, 1892.

Height of Barometer above Mean Sea-level=37 feet.

1892. Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
1	29·891	**29·958**	29·817	29·835	29·803	**29·492**	29·611	**29·621**	29·652	29·803	**29·755**	29·953
2	·861	·953	·875	·843	**·863**	·641	·586	·654	**·598**	·894	·780	·970
3	·898	·919	·924	·849	·831	·730	·581	·687	·622	**·908**	·846	30·009
4	·964	·878	**·925**	**·862**	·743	·706	·576	·694	·689	·841	·905	·000
5	·938	·838	·894	·812	·719	·649	·535	·698	·708	·866	·882	29·964
6	·923	·836	·900	·772	·739	·603	**·496**	·696	·737	·900	·866	·952
7	·907	·840	·874	·772	·768	·559	·509	·707	·752	·897	·870	·977
8	·897	·859	·836	·757	·767	·545	·542	·708	·768	·851	·865	·978
9	·874	·857	·817	·776	·772	·539	·569	·751	·716	·837	·866	·957
10	·859	·847	·845	·758	·803	·578	·546	·751	·681	·841	·914	·922
11	**·851**	·860	·826	·736	·804	·608	·525	·719	·697	·834	·976	·942
12	·907	·914	·809	·725	·824	·653	·562	·740	·713	·840	**·984**	·967
13	·910	·924	·789	·726	·807	·660	·626	**·769**	·789	·820	·937	·961
14	·895	·891	·756	·741	·805	·672	·681	·744	·857	·807	·928	**·910**
15	·902	·862	·745	·720	·759	·731	·694	·727	**·863**	·790	·961	·943
16	·912	·885	·783	·702	·777	**·761**	·675	·741	·817	·795	·963	·988
17	·928	·885	·779	·733	·805	·734	·629	·753	·766	·742	·933	·968
18	·935	·905	·800	·734	·781	·696	·623	·707	·764	·693	·907	·958
19	·937	·898	·811	·722	·784	·700	·685	·680	·737	·805	·916	·942
20	·964	·874	·782	·737	·741	·725	**·711**	·682	·697	·813	·906	·975
21	·974	·826	·766	·734	·709	·740	·636	·674	·723	·741	·882	30.007
22	·971	·821	·754	·709	·725	·713	·588	·645	·709	·707	·850	29·984
23	·976	·819	·791	·713	·706	·690	·622	·631	·698	·738	·855	·976
24	**·991**	·807	·800	·681	·688	·686	·588	·629	·731	·750	·919	·979
25	·991	·803	·771	**·627**	·700	·682	·572	·632	·776	**·686**	·922	·969
26	·959	·825	**·743**	·713	·728	·651	·614	·651	·770	·715	·888	·962
27	·938	·836	·766	·810	·764	·650	·646	·656	·777	·778	·868	·954
28	·958	·823	·787	·858	·764	·646	·649	·661	·809	·801	·910	·948
29	·971	**·794**	·775	·862	·706	·646	·661	·672	·814	·754	·943	·962
30	·967		·792	·807	·653	·630	·665	·696	·761	·722	·921	·999
31	·959		·819		**·538**		·641	·702		·735		**30·017**
Monthly Mean.	29·929	29·863	29·811	29·761	29·754	29·657	**29·608**	29·693	29·740	29·797	29·897	**29·968**
Annual Variation... ...	+·139	+·073	+·021	−·029	−·036	−·133	−·182	−·097	−·050	+·007	+·107	+·178

	in.
Annual mean	29·790
The greatest mean daily barometric pressure in the year (that of 31st December) was ...	30·017
The least do. do. (that of 1st June) was ...	29·492
Difference =	0·525

TABLE X.—Temperature of the Air, 1892.

1892. Date.	MONTH. January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	°	°	°	°	°	°	°	°	°	°	°	°
1	74·6	78·4	76·1	**81·5**	85·7	83·7	83·6	79·1	**75·4**	**78·6**	79·8	76·0
2	75·1	79·2	75·6	83·6	**83·8**	82·4	83·7	80·3	76·2	78·9	79·5	75·7
3	76·2	78·4	**73·7**	83·8	85·5	84·3	83·9	79·8	76·1	80·1	78·2	75·2
4	76·4	79·2	73·7	84·0	88·2	81·7	84·4	80·9	78·1	80·8	78·5	76·4
5	77·5	79·2	75·2	84·3	**89·0**	81·6	**84·9**	79·9	79·3	81·7	80·3	75·5
6	76·4	79·5	76·6	85·6	87·1	81·0	84·4	80·5	79·0	81·7	**81·3**	75·4
7	76·8	**79·6**	77·0	85·5	85·6	81·9	81·3	78·1	79·8	81·4	80·6	75·6
8	76·5	78·2	77·7	84·8	85·3	**78·8**	81·0	78·0	79·0	80·7	79·6	75·7
9	75·7	78·5	76·3	85·1	85·5	80·6	79·8	79·4	79·1	82·0	78·2	74·6
10	75·1	78·2	76·3	84·4	85·6	81·3	80·5	79·2	79·7	81·0	79·9	74·4
11	74·4	76·1	76·8	84·3	84·9	82·5	80·8	79·3	78·5	83·2	78·7	75·3
12	74·0	75·5	78·4	84·1	85·3	82·7	82·0	79·3	79·5	82·8	78·4	76·1
13	73·6	**75·2**	78·4	83·8	85·3	81·6	81·3	78·4	78·3	83·1	78·0	75·4
14	73·6	75·3	78·7	84·7	85·1	82·9	81·8	78·9	78·0	82·6	78·2	75·4
15	73·8	75·2	79·5	84·8	84·5	83·9	81·7	79·6	79·7	82·5	78·3	75·3
16	73·4	76·3	80·5	85·1	84·8	81·2	81·7	78·4	80·1	**83·4**	77·8	75·1
17	73·1	78·1	79·9	84·8	84·3	81·0	79·7	76·8	77·7	83·4	76·3	77·0
18	73·4	78·0	80·5	84·9	84·8	82·0	80·5	78·4	77·9	81·5	76·8	**79·5**
19	76·4	77·0	81·4	85·7	84·5	83·5	81·2	80·4	76·1	81·2	77·4	79·0
20	77·3	76·7	81·0	85·4	85·1	84·1	81·4	80·8	78·0	80·9	76·8	78·0
21	76·8	76·9	79·4	84·8	86·1	83·7	81·0	80·7	79·8	81·0	76·3	76·5
22	74·3	77·3	80·4	84·7	86·6	82·0	81·0	80·6	78·5	79·1	76·5	75·0
23	**70·4**	77·8	81·3	85·8	86·6	81·1	81·5	80·5	79·3	78·8	76·5	74·5
24	74·5	77·5	81·3	86·7	86·8	82·2	80·5	80·6	79·4	79·5	76·7	**73·5**
25	77·3	76·7	81·6	**87·0**	86·2	81·8	80·2	**81·2**	80·5	80·3	76·8	74·9
26	**78·5**	77·0	83·1	87·0	85·9	83·8	81·0	78·5	80·3	81·3	77·3	75·0
27	77·4	76·0	82·7	86·4	85·7	84·2	80·2	78·8	80·2	80·9	78·2	74·2
28	77·5	75·6	**83·2**	85·6	85·4	84·4	79·7	77·5	80·3	80·6	77·3	75·3
29	77·0	76·2	82·5	85·1	85·7	84·2	**77·4**	76·4	80·1	80·5	76·5	76·8
30	76·9		81·4	85·3	85·8	**84·7**	79·2	77·2	**80·8**	81·8	**75·9**	75·9
31	77·4		81·3		85·1		79·8	**75·6**		81·6		75·3
Monthly Mean.	**75·5**	77·3	79·1	85·0	**85·7**	82·5	81·3	79·1	78·8	81·2	78·0	75·7
Annual Variation ...	−4·4	−2·6	−0·8	+5·1	+5·8	+2·6	+1·4	−0·8	−1·1	+1·3	−1·9	−4·2

	°
Annual mean	79·9
The greatest mean daily temperature of the air in the year (that of 5th May) was ...	89·0
The least do. do. (that of 23rd January) was ...	70·4
Difference =	18·6

TABLE XI.—Pressure of Vapour, 1892.

1892. Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
1	0·568	0·649	0·653	0·851	0·878	0·875	**0·982**	0·859	0·827	0·830	**0·869**	**0·547**
2	·610	·643	·674	**·794**	**·787**	·868	·981	·869	·844	·856	·774	·551
3	·621	·701	·565	·858	·884	·921	·971	·863	·827	·864	·655	·578
4	·613	·717	**·492**	·916	·884	**·860**	·959	·877	·862	·897	·631	·616
5	·631	·740	·496	·891	·806	·894	·965	·875	·857	·909	·744	·600
6	·619	**·821**	·611	·865	·922	·909	·953	·888	·857	·918	·829	·615
7	·659	·795	·661	·893	·928	·946	·928	·850	·884	·908	·734	·643
8	·676	·774	·596	·910	·864	·891	·934	·861	·870	·895	·648	·654
9	·673	·705	·659	·910	·888	·912	·911	·878	·835	·904	·714	·645
10	·573	·707	·710	·924	·842	·921	·918	·892	·810	·897	·623	·625
11	·571	·670	·688	·919	·860	·951	·901	·877	**·804**	·896	·570	·629
12	·593	·618	·762	·877	·851	·930	·890	·868	·838	·875	·590	·647
13	·542	·603	·800	·877	·877	·933	·889	·863	·822	·845	·647	·640
14	·554	·518	·811	·889	·847	·943	·905	·870	·813	·845	·641	·655
15	·561	**·452**	·860	·905	·833	·939	·896	·874	·832	·848	·581	·642
16	·557	·596	·863	·957	·843	·936	·895	·868	·843	·822	·562	·667
17	**·466**	·606	·826	·942	·824	·922	·888	·848	·843	**·699**	**·557**	·697
18	·495	·680	·827	·947	·867	·913	·895	·877	·836	·834	·605	**·781**
19	·657	·711	·810	·903	·835	·909	·903	·885	·838	·881	·615	·746
20	·649	·680	·778	·893	·844	·915	·898	·868	·873	·897	·640	·698
21	·714	·673	·792	·914	·878	·944	·886	·853	**·920**	**·930**	·677	·627
22	·612	·619	·819	·925	·918	·942	·885	·863	·888	·898	·695	·621
23	·487	·585	·828	·917	·914	·930	·894	·863	·901	·893	·672	·589
24	·625	·468	·843	·847	**·930**	·921	·885	·879	·894	·910	·647	·592
25	·705	·540	·819	·918	·905	·907	·879	**·896**	·891	·880	·636	·601
26	·695	·569	·792	**·959**	·877	·931	·883	·885	·878	·816	·625	·665
27	·709	·543	**·918**	·913	·891	·944	·874	·889	·872	·840	·613	·632
28	·687	·481	·904	·873	·916	·940	·871	·860	·836	·832	·577	·642
29	**·723**	·599	·864	·851	·904	·956	**·864**	·848	·819	·873	·601	·703
30	·717		·829	·861	·898	**·984**	·878	·856	·821	·907	·573	·687
31	·700		·839		·928		·880	**·826**		·914		·625
Monthly Mean.	**0·621**	0·637	0·755	0·897	0·875	**0·923**	0·908	0·869	0·851	0·871	0·652	0·641
Annual Variation	—·171	—·155	—·037	+·105	+·083	+·131	+·116	+·077	+·059	+·079	—·140	—·151

	in.
Annual mean	0·792
The greatest mean daily pressure of vapour in the year (that of 30th June) was ...	0·984
The least do. do. do. do. (that of 15th February) was ...	0·452
Difference =	0·532

TABLE XII.—Additional Capacity of the Air, 1892.

1892. Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
1	0·297	0·329	0·252	**0·229**	0·355	**0·285**	0·168	0·134	**0·053**	0·149	**0·150**	**0·357**
2	·269	·360	·215	·362	·371	·240	·176	·165	·058	·131	·233	·345
3	·289	·277	·268	·304	·346	·259	·194	·152	·073	·165	·312	·308
4	·304	·288	·345	·252	·456	·227	·222	·177	·100	·157	·351	·300
5	·324	·263	**·393**	·290	**·566**	·185	**·237**	.143	·142	·172	·295	·291
6	·296	**·187**	·312	·371	·371	·151	·230	·155	·133	·172	·241	·271
7	·269	·218	·273	·331	·303	·141	·139	·113	·135	·164	·315	·251
8	·241	·194	·359	·291	·356	**·094**	·124	·097	·121	·155	·368	·239
9	·218	·275	·251	·300	·337	·131	·106	·130	·159	·192	·255	·217
10	·303	·260	·199	·260	·344	·148	·123	·105	·203	·176	·406	·230
11	·285	·233	·238	·260	·341	·161	·151	·123	·171	·251	**·419**	·252
12	·251	·269	·212	·295	·367	·188	·203	·131	·173	·249	·388	·260
13	·289	·275	·174	·282	·343	·146	·177	·110	·147	·294	·320	·245
14	·279	·361	·174	·306	·361	·181	·179	·118	·146	·274	·332	·230
15	·278	·432	**·151**	·295	·352	·209	·186	·138	·185	·269	·394	·239
16	·271	·324	·179	·252	·356	·127	·189	·102	·185	·325	·399	**·208**
17	**·351**	·367	·197	·261	·356	·136	·128	·074	·107	**·451**	·357	·236
18	·332	·282	·212	·255	·331	·180	·146	·096	·118	·242	·327	·233
19	·259	·220	·266	·330	·351	·244	·163	·153	·063	·184	·334	·249
20	·297	·244	·278	·330	·365	·255	·174	·184	·086	·160	·291	·266
21	·211	·255	·214	·283	·371	·211	·170	**·196**	·098	·129	·237	·289
22	·238	·323	·223	·271	·349	·152	·172	·182	·087	·096	·224	·251
23	·262	·370	·243	·322	·356	·132	·182	·179	·100	**·095**	·244	·270
24	·235	**·482**	·228	**·429**	·348	·183	·153	·167	·111	·100	·277	·239
25	·238	·387	·264	·370	·346	·181	·151	·170	·151	·154	·292	·269
26	·288	·365	·338	·324	·364	·229	·177	·090	·157	·255	·320	·215
27	·235	·360	·202	·349	·343	·234	·161	·095	·160	·214	·361	·215
28	·263	·410	·234	·359	·345	·242	·145	·084	·202	·215	·365	·241
29	**·207**	·315	·248	·358	·331	·219	**·077**	·061	·210	·171	·316	·220
30	·215		·247	·356	·337	·210	·120	·080	**·232**	·183	·329	·211
31	·247		·233		**·279**		·135	**·059**		·166		·257
Monthly Mean.	0·269	0·308	0·246	0·309	**0·358**	0·189	0·163	**0·128**	0·135	0·197	0·315	0·255
Annual Variation	+·030	+·069	+·007	+·070	+·119	—·050	—·076	—·111	—·104	—·042	+·076	+·016

	in.
Annual mean...	0·239

The greatest mean daily additional capacity of the air in the year (that of 5th May) was 0·566
The least do. do. do. (that of 1st September) was 0·053

Difference = ... 0·513

Rainfall, 1892.

TABLE XIII.—*Total Fall of Rain (in inches) as measured by F. Chambers's Self-registering Gauge, the funnel of which is 28 feet above the ground.*

1892.	MONTH.											
Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
					in.	in.	in.	in.	in.	in.	in.	
1					0·10		0·61	1·23	5·18	0·54	0·62	
2						0·04	0·14	0·14	3·73			
3						0·33	0·01	0·05	2·75			
4						0·01		0·16	0·42			
5						0·18		0·25	0·06			
6						1·48	0·44	0·20	0·20			
7						0·80	2·53	1·31	0·10			
8						2·22	1·69	1·11	0·27			
9						0·15	2·35	0·21	0·05			
10						0·22	2·22	0·73				
11							1·41	1·00	0·08			
12							0·15	0·51	0·21			
13						0·37	0·49	2·32	0·19			
14						0·09	0·17	0·85	0·12			
15						0·05	0·17	0·38	0·01			
16						0·66	0·06	0·76	0·05			
17						0·26	2·21	3·77	1·63			
18						0·01	0·21	0·55	1·03	0·01		
19						0·01	0·20		0·94			
20						0·10	0·10	0·01	0·18			
21						0·07	0·28	0·03		0·07		
22						3·14	0·08	0·06	0·97	0·50		
23						1·20	0·04	0·01	0·08	0·60		
24							0·56		0·38	0·01		
25						0·84	0·43	0·03	0·02			
26						0·02	0·10	1·92				
27						0·11	0·15	2·94				
28							1·87	4·72				
29						0·03	3·73	4·41				
30						0·01	0·32	1·25				
31							0·23	5·40				
Monthly Total.					·010	12·40	22·95	36·31	18·65	1·73	0·62	
Number of rainy days ...					1	25	29	29	23	6	1	

Total fall of rain in the year ... ... 92·76 inches.
Total number of rainy days in the year 114
The greatest daily fall of rain in the year (that of 31st August) was ... ... 5·40 inches.
No rain fell in the months of January, February, March, April and December, nor on any of the days left blank in the above table.

Mean Daily Velocities of the North and East Components of the Wind, 1892.

TABLE XIV.—*Showing the Mean Velocities of the North or South and East or West Components of the Winds which blew on each day of the year 1892.*

In Miles per Hour.

1892.	MONTH.																							
Date.	January.		February.		March.		April.		May.		June.		July.		August.		September.		October.		November.		December.	
	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.
1	4·5 N	1·8 E	2·8 N	0·5 E	0·3 N	1·9 W	2·0 N	4·5 W	10·0 S	8·1 W	20·8 S	9·5 E	4·8 S	2·5 W	5·4 S	17·6 W	1·9 N	13·2 W	3·2 S	0·3 E	5·4 S	2·8 E	4·5 N	3·7 E
2	4·1 N	2·9 E	3·6 N	0·4 W	3·9 N	4·6 W	4·1 N	6·8 W	9·3 N	6·7 W	24·3 S	3·8 E	6·1 S	1·5 E	7·8 S	15·5 W	2·1 N	21·8 W	3·4 S	1·6 W	3·7 N	0·9 W	3·4 N	4·4 E
3	2·4 N	1·1 E	3·9 N	0·1 W	11·0 N	7·7 W	3·4 S	5·9 W	14·9 N	6·1 W	10·0 S	0·7 W	5·3 S	1·5 E	7·1 S	14·3 W	5·4 N	22·1 W	0·1 N	1·4 W	6·9 N	1·3 E	5·5 N	3·2 E
4	1·9 N	1·7 E	3·4 N	1·1 W	12·1 N	2·1 W	4·1 S	4·4 W	13·7 N	6·7 W	1·0 S	1·9 W	8·7 S	1·3 E	7·9 S	16·5 W	2·7 S	18·0 W	5·2 N	2·7 W	8·0 N	0·8 W	7·3 N	3·4 E
5	6·4 N	2·6 E	0·3 N	1·4 W	8·7 N	1·7 W	0·1 S	3·6 W	14·7 N	8·8 W	2·8 S	5·6 W	10·7 S	2·7 E	6·7 S	16·7 W	7·4 S	17·9 W	6·3 N	2·1 W	5·2 N	0·5 W	5·9 N	3·0 E
6	6·1 N	1·1 W	9·9 S	1·8 W	5·5 N	4·6 W	0·8 S	6·0 W	3·1 S	5·3 W	8·8 S	2·1 W	17·0 S	4·3 E	6·7 S	16·1 W	6·8 S	15·3 W	5·1 N	1·6 W	3·0 N	0·4 W	5·2 N	4·0 E
7	2·4 N	1·3 W	5·3 S	3·8 W	10·2 N	5·9 W	0·2 N	6·2 W	7·3 S	6·7 W	7·1 S	4·6 W	18·9 S	3·0 E	6·4 S	11·8 W	0·1 S	14·4 W	7·5 N	2·9 W	6·5 N	1·0 W	5·8 N	1·9 E
8	2·5 N	1·9 W	4·7 N	2·5 W	9·1 N	4·5 W	6·6 S	5·5 W	6·7 S	7·0 W	3·2 S	2·7 W	11·3 S	14·9 W	5·6 S	4·0 W	1·4 S	14·3 W	6·2 N	2·2 W	6·1 N	0·6 E	3·3 N	1·7 E
9	6·2 N	3·1 W	5·9 N	3·0 W	10·0 N	6·3 W	7·0 S	3·3 W	6·4 S	7·1 W	3·9 S	2·4 W	8·4 S	18·6 W	6·0 S	6·8 W	1·4 N	9·1 W	7·3 N	2·0 W	3·3 N	0·5 W	3·8 N	0·2 W
10	9·6 N	1·9 W	4·0 N	4·7 W	6·9 N	6·9 W	2·8 S	4·5 W	2·6 S	8·0 W	5·0 S	4·9 W	9·3 S	24·8 W	2·4 N	13·8 W	0·2 S	10·1 W	5·5 N	3·2 W	4·6 N	6·8 E	5·5 N	0·2 W
11	5·0 N	1·4 W	3·5 N	3·7 W	5·3 N	4·0 W	0·7 S	4·7 W	0·8 N	7·4 W	18·6 S	1·8 W	12·1 S	29·2 W	0·0	14·3 W	2·7 S	8·8 W	3·9 N	0·6 W	5·2 N	5·6 E	3·3 N	1·6 E
12	6·2 N	1·2 W	4·9 N	2·1 W	2·8 N	4·7 W	1·3 S	5·6 W	0·2 N	9·1 W	17·0 S	0·3 E	10·5 S	22·2 W	3·9 S	12·3 W	2·9 S	11·3 W	2·1 N	0·6 W	5·8 N	4·8 E	2·5 N	1·9 E
13	11·0 N	2·7 W	8·5 N	1·0 W	1·7 S	4·4 W	0·4 S	5·8 W	2·4 N	7·4 W	17·1 S	0·1 W	8·9 S	21·5 W	1·9 S	13·6 W	7·2 S	5·7 W	1·9 N	2·0 E	4·5 N	1·8 E	2·7 N	2·3 E
14	9·3 N	1·6 W	13·2 N	3·7 W	2·4 S	3·2 W	1·5 N	5·1 W	2·9 N	8·4 W	15·8 S	6·4 W	10·4 S	18·5 W	1·5 S	10·2 W	5·9 S	1·9 W	1·9 N	2·1 E	4·6 N	4·4 E	0·3 N	1·3 E
15	8·2 N	2·3 W	10·0 N	0·2 W	9·5 S	1·9 W	5·7 S	6·4 W	3·8 N	8·8 W	14·7 S	4·6 W	13·0 S	13·4 W	2·3 S	8·8 W	1·1 N	5·5 W	5·3 N	0·5 E	6·0 N	5·3 E	0·2 S	1·1 E
16	7·9 N	2·3 W	4·9 N	0·3 E	5·7 S	3·8 W	1·9 N	7·3 W	3·3 N	9·9 W	12·3 S	0·6 W	8·9 S	16·6 W	3·2 S	5·9 W	3·9 N	4·4 W	6·6 N	1·3 E	6·4 N	5·2 E	6·9 N	0·6 W
17	12·1 N	4·0 W	4·8 N	0·5 W	1·2 S	3·6 W	0·5 S	5·8 W	6·6 N	10·0 W	8·5 S	1·3 W	5·9 S	19·3 W	1·9 S	6·2 W	3·2 N	2·4 W	7·2 N	3·1 E	5·5 N	2·5 E	7·2 N	0·9 E
18	9·2 N	1·4 W	7·0 N	3·1 W	1·4 S	4·3 W	2·4 N	6·4 W	5·5 N	8·9 W	7·8 S	2·4 W	9·5 S	22·9 W	4·1 S	4·3 W	3·8 N	4·1 W	2·4 S	3·9 E	5·2 N	2·9 E	4·0 N	1·0 E
19	3·2 N	0·6 E	9·0 N	5·7 W	1·6 N	2·8 W	1·6 S	7·1 W	1·9 N	8·0 W	0·8 S	3·9 W	9·8 S	23·7 W	2·8 S	7·9 W	0·4 N	4·4 W	6·1 S	1·6 E	3·7 N	3·1 E	5·4 N	0·2 W
20	0·2 N	1·7 E	4·1 N	3·9 W	1·5 S	5·1 W	1·1 N	7·4 W	1·9 S	9·1 W	3·7 N	7·1 W	6·8 S	23·5 W	0·3 S	9·7 W	5·9 S	1·1 W	0·3 S	2·7 W	5·6 N	2·7 E	5·0 N	2·7 E
21	1·0 N	0·9 W	7·1 N	3·8 W	3·6 N	0·2 W	0·2 N	8·0 W	3·9 S	10·3 W	1·8 N	3·8 W	8·5 S	22·5 W	0·9 S	11·9 W	3·5 S	0·7 W	2·0 N	2·2 W	4·2 N	2·9 E	3·8 N	0·5 E
22	13·0 N	3·9 W	11·4 N	4·2 W	8·6 N	7·2 W	2·8 N	7·7 W	6·2 S	10·7 W	2·7 S	2·6 W	7·6 S	16·9 W	2·5 S	9·3 W	2·0 N	2·6 W	0·5 N	2·7 W	3·7 N	1·8 E	4·7 N	0·4 E
23	9·2 N	2·5 W	13·8 N	5·4 W	1·5 S	4·4 W	7·8 N	8·6 W	7·0 S	11·2 W	10·9 S	0·7 W	8·6 S	13·7 W	5·9 S	2·3 W	18·7 S	2·7 E	1·2 S	1·3 E	5·3 N	0·0	5·5 N	0·7 E
24	2·9 N	0·4 E	11·4 N	2·8 W	1·2 S	5·2 W	10·5 N	7·9 W	5·2 S	10·5 W	13·2 S	0·9 W	7·8 S	17·9 W	1·2 S	1·4 W	1·9 S	8·6 W	0·5 N	0·1 W	6·2 N	0·3 E	2·9 N	0·9 E
25	2·7 N	0·4 E	9·9 N	4·2 W	5·1 N	7·3 W	1·6 S	5·5 W	1·5 S	9·1 W	4·8 S	2·0 W	7·3 S	18·4 W	6·1 N	3·2 W	1·5 N	8·7 W	3·2 N	2·9 W	5·8 N	0·8 E	1·9 N	2·2 E
26	2·3 N	0·9 E	13·5 N	6·2 W	9·4 N	7·1 W	24·6 N	8·3 W	0·1 S	7·8 W	1·9 S	5·0 W	7·3 S	17·6 W	5·4 N	9·0 W	7·0 N	8·3 W	2·5 S	3·7 W	5·6 N	4·4 E	0·8 N	1·6 W
27	2·8 N	0·7 W	14·0 N	5·2 W	11·0 S	4·4 W	11·2 S	6·3 W	0·2 N	7·1 W	3·8 S	3·4 W	2·9 S	17·3 W	0·8 N	18·5 W	6·3 N	4·9 W	10·1 S	2·3 E	4·6 N	7·6 E	4·1 N	1·0 W
28	2·8 N	1·3 W	11·0 N	5·4 W	14·5 S	5·6 W	1·8 S	7·0 W	2·3 N	7·9 W	6·3 S	4·6 W	5·5 S	10·9 W	0·0	16·9 W	4·8 N	5·5 W	0·5 S	0·9 W	4·6 N	2·0 E	1·8 N	3·3 E
29	0·2 S	0·0	5·1 N	2·6 W	12·3 S	6·5 W	1·0 N	7·3 W	4·3 N	8·8 W	10·1 S	3·8 W	6·0 S	11·2 W	2·0 N	15·5 W	3·9 N	4·2 W	4·8 N	3·0 W	4·3 N	2·3 E	0·4 N	0·7 W
30	3·9 N	1·2 W			4·3 S	3·7 W	1·1 S	5·9 W	7·6 N	12·9 W	6·5 S	2·1 W	1·7 S	16·5 W	2·0 N	12·3 W	3·3 N	4·5 W	1·9 S	1·5 W	6·2 N	2·4 E	7·3 N	0·1 E
31	4·2 N	0·9 W			0·9 S	4·5 W			15·0 N	12·0 W			1·8 S	16·6 W	3·4 N	11·1 W			7·4 S	0·2 W			8·2 N	1·0 W
Monthly Mean ...	5·3 N	0·8 W	6·2 N	2·8 W	1·5 N	4·7 W	0·9 S	6·2 W	1·5 N	8·6 W	8·5 S	2·3 W	8·4 S	14·1 W	2·2 S	10·9 W	0·5 S	8·4 W	1·4 N	0·7 W	4·8 N	2·4 E	4·2 N	1·3 E
Annual Variation	4·9 N	3·8 E	5·8 N	1·8 E	1·1 N	0·1 W	1·3 S	1·6 W	1·1 N	4·0 W	8·9 S	2·3 E	8·8 S	9·5 W	2·6 S	6·3 W	0·9 S	3·8 W	4·0 N	3·9 E	4·4 N	7·0 E	3·8 N	5·9 E

The Velocities of the Mean Components for the year are 0·4 N. and 4·6 W.

Velocity of Wind, 1892.

TABLE XV.—*Mean Velocity of the Wind, in miles per hour, without regard to the direction from which it blew, for each Day of Bombay Civil Time: also the Mean Monthly Velocity, and its Variation from the Mean of the year.*

1892.	MONTH.											
Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.
1 ...	8·1	7·3	**5·7**	6·7	14·7	**27·2**	7·9	18·7	15·1	6·2	8·8	10·1
2 ...	9·2	8·7	9·5	9·9	14·1	26·6	8·8	17·7	22·2	7·2	7·8	10·0
3 ...	8·8	7·4	13·8	9·0	17·0	13·7	**7·5**	16·2	**23·6**	6·0	10·3	8·1
4 ...	8·5	**6·8**	15·6	8·2	16·0	7·5	10·5	18·4	19·0	7·4	8·9	11·0
5 ...	9·9	6·8	10·7	8·5	17·6	8·5	12·5	18·1	19·4	9·5	8·2	**11·2**
6 ...	8·4	11·7	8·6	11·7	8·2	10·3	19·0	17·4	16·8	6·5	7·0	10·8
7 ...	**5·7**	7·7	12·2	11·8	10·9	9·6	22·1	14·2	14·5	9·5	8·1	8·5
8 ...	5·9	10·2	11·6	11·1	10·8	8·2	19·5	9·7	14·5	7·9	8·3	7·9
9 ...	8·6	8·3	12·5	11·1	10·6	8·6	21·0	11·1	9·4	8·8	**6·5**	7·5
10 ...	11·3	7·6	11·5	8·7	8·7	12·9	26·7	14·6	10·2	7·3	10·6	7·6
11 ...	9·0	7·8	8·0	9·1	7·7	19·5	**31·6**	14·6	9·4	5·9	10·9	7·0
12 ...	8·9	9·3	7·8	9·5	9·4	17·8	24·8	13·0	12·0	6·6	10·7	6·5
13 ...	12·6	11·6	7·5	8·6	7·9	18·2	23·2	14·1	10·5	7·0	8·8	6·8
14 ...	11·2	14·7	6·1	9·0	9·8	17·2	21·6	11·0	10·0	8·6	9·6	**5·7**
15 ...	9·6	12·1	10·6	9·7	10·0	15·8	18·8	9·4	6·4	8·5	11·6	6·2
16 ...	9·7	7·9	8·1	8·9	10·9	14·1	19·3	9·3	7·5	10·0	11·5	10·3
17 ...	13·6	8·1	6·5	**6·5**	12·9	10·3	20·5	9·0	7·7	10·2	10·7	9·6
18 ...	10·7	11·5	6·5	9·2	11·5	9·3	24·8	9·4	9·5	**13·5**	9·6	8·4
19 ...	8·0	11·6	7·0	11·6	8·6	7·3	25·6	8·6	10·2	7·6	9·8	7·5
20 ...	7·3	8·5	6·5	8·2	9·5	8·1	24·9	9·8	9·2	**3·5**	9·4	9·1
21 ...	8·8	10·8	9·0	8·5	11·0	**5·7**	24·2	12·1	**6·1**	5·6	9·4	8·2
22 ...	**14·0**	15·0	12·5	9·5	12·6	6·2	18·7	10·0	7·0	7·5	7·2	8·0
23 ...	11·1	**16·2**	6·9	13·2	13·5	13·8	16·5	7·8	19·7	6·5	8·5	7·8
24 ...	8·1	14·2	7·1	14·0	11·8	14·6	19·7	**6·5**	9·8	5·5	9·1	6·9
25 ...	8·0	11·4	9·2	15·3	9·5	7·3	20·2	9·5	9·3	6·7	9·2	7·4
26 ...	6·8	15·7	12·6	**26·3**	8·0	6·7	19·1	12·6	11·3	6·3	10·2	5·7
27 ...	5·8	15·8	16·0	13·6	**7·3**	6·5	18·0	**19·1**	9·5	12·2	**12·0**	7·3
28 ...	7·0	12·8	**16·7**	7·6	8·8	8·4	13·7	17·3	8·3	6·3	9·1	7·5
29 ...	7·1	7·6	14·6	7·7	10·5	11·5	14·8	16·2	6·7	8·0	9·4	5·8
30 ...	7·2		7·9	7·0	15·3	8·3	16·9	14·4	7·2	5·2	9·7	11·1
31 ...	7·2		6·7		**20·2**		17·1	13·4		8·7		9·8
Monthly Mean	8·9	10·5	9·8	10·3	11·5	12·0	**19·0**	13·0	11·7	**7·6**	9·4	8·2
Annual Variation ...	—2·1	—0·5	—1·2	—0·7	+0·5	+1·0	+8·0	+2·0	+0·7	—3·4	—1·6	—2·8

	Miles.
The Mean Velocity for June to August	14·7
The Mean Velocity for September to May	9·8
The Mean Velocity for the year	11·0
The greatest monthly mean (that of July)	19·0
The least monthly mean (that of October)	7·6
Difference =	11·4
The greatest mean daily Velocity of Wind in the year (that of 11th July) was ...	31·6
The least do. do. do. (that of 20th October) was ...	3·5
Difference =	28·1

Aggregate and Mean Velocities and Relative Frequency of Different Winds, 1892.

TABLE XVI.—*Showing, for the year 1892, the sums of the Velocities, and the Mean Velocities, in miles per hour, of the Winds which blew in each Month, from each of the sixteen Principal Directions; and also the number of hourly Observations which those sums comprise; the latter numbers indicating the Relative Frequency of the same Wind (as to direction) in the several Months and of different Winds during the same Month.*

1892.	N.			N.N.E.			N.E.			E.N.E.			E.			E.S.E.			S.E.			S.S.E.		
Month.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.
	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.
January ...	620	81	7·7	468	72	6·5	398	59	6·7	838	120	7·0	282	41	6·9	304	35	8·7	10	1	10·0	19	3	6·3
February ..	490	63	7·8	443	61	7·3	305	41	7·4	571	72	7·9	158	24	6·6	71	12	5·9	69	10	6·9	49	4	12·2
March ...	455	58	7·8	111	19	5·8	122	17	7·2	178	28	6·4	58	12	4·8	0	0	0·0	81	13	6·2	160	25	6·4
April ...	135	24	5·6	92	17	5·4	19	4	4·7	37	6	6·2	5	1	5·0	6	1	6·0	74	14	5·3	270	32	8·4
May ...	266	29	9·2	88	10	8·8	11	2	5·5	25	2	12·5	0	0	0·0	0	0	0·0	0	0	0·0	24	2	12·0
June ...	9	0	0·0	25	5	5·0	18	5	3·6	88	10	8·8	67	6	11·2	86	12	7·2	344	28	12·3	1,614	98	16·5
July ...	0	0	0·0	0	0	0·0	0	0	0·0	0	0	0·0	19	3	6·3	115	17	6·8	380	33	11·5	608	34	17·9
August ...	29	5	5·8	18	4	4·5	35	6	5·8	38	6	6·3	9	1	9·0	53	10	5·3	23	3	7·7	251	22	11·4
September ...	94	18	5·2	99	19	5·2	29	5	5·8	44	8	5·5	35	5	7·0	96	12	8·0	59	7	8·4	399	25	16·0
October ..	300	52	5·8	211	30	7·0	294	42	7·0	440	58	7·6	203	40	5·1	298	49	6·1	346	53	6·5	297	30	9·9
November ...	560	81	6·9	320	49	6·5	431	63	6·8	2,297	222	10·3	421	47	9·0	194	24	8·1	51	10	5·1	36	3	12·0
December ...	486	79	6·2	267	47	5·7	364	56	6·5	1,710	183	9·3	660	98	6·7	123	20	6·1	0	0	0·0	5	1	5·0
Year ..	3,435	490	7·0	2,142	333	6·4	2,026	300	6·8	6,266	715	8·8	1,917	278	6·9	1,346	192	7·0	1,437	172	8·4	3,732	279	13·4

1892.	S.			S.S.W.			S.W.			W.S.W.			W.			W.N.W.			N.W.			N.N.W.			No. of Observations.		No. of hours.
Month.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations	Mean Velocity.	Sum of Velocities	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Calm.	Variable.	Record lost.
	Miles.		Miles.	Miles		Miles.	Miles.		Miles	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.			
January ...	0	0	0·0	0	0	0·0	0	0	0·0	33	5	6·6	386	45	8·6	680	76	8·9	1,047	95	11·0	1,538	111	13·9	0	0	0
February ...	96	8	12·0	115	10	11·5	103	16	6·4	98	10	9·8	123	13	9·5	746	74	10·1	2,025	153	13·2	1.862	124	15·0	1	0	0
March ...	395	27	14·6	921	74	12·4	426	57	7·5	473	57	8·3	465	56	8·3	931	86	10·8	1,822	149	12·2	712	62	11·5	4	0	0
April ..	776	51	15·2	1,024	57	18·0	376	56	6·7	503	60	8·4	1,268	137	9·3	1,528	143	10·7	1,163	95	12·2	165	21	7·9	1	0	0
May ...	81	7	11·6	413	28	14·7	586	57	10·3	1,792	165	10·9	1,384	154	9·0	1.598	139	11·5	1,542	99	15·6	715	50	14·3	0	0	0
June ...	1,982	111	17·9	2,163	162	13·4	694	91	7·6	573	68	8·4	493	64	7·7	349	43	8·1	130	16	8·1	9	1	9·0	0	0	0
July ...	474	28	16·9	442	34	13·0	1,547	89	17·4	9,006	420	21·4	1,496	80	18·7	52	5	10·4	8	1	8·0	0	0	0·0	0	0	0
August ...	135	14	9·6	184	21	8·8	372	38	9·8	4,114	290	14·2	3,015	218	13·8	1,101	77	14·3	210	17	12·4	89	12	7·4	0	0	0
September...	422	35	12·1	160	15	10·7	183	23	8·0	1,797	125	14·4	2,588	197	13·1	1,643	133	12·4	574	66	8·7	226	27	8·4	0	0	0
Octor ...	284	26	10·9	257	28	9·2	130	30	4·3	144	22	6·5	289	40	7·2	605	63	9·6	883	100	8·8	688	79	7·7	2	0	0
November...	52	4	13·0	29	7	4·1	7	1	7·0	0	0	0·0	53	7	7·6	411	44	9·3	1,036	94	11·0	845	64	13·2	0	0	0
December ...	0	0	0·0	0	0	0·0	0	0	0·0	67	13	5·2	266	36	7·4	596	73	8·2	767	75	10·2	818	63	13·0	0	0	0
Year ...	4,697	311	15·1	5,708	436	13·1	4,424	458	9·7	18,600	1,235	15·1	11,826	1,047	11·3	10,240	956	10·7	11,207	960	11·7	7,667	614	12.5	8	0	0

Extent of Cloudy Sky, 1891.

TABLE XVII.—*Means of Estimations made at 6, 10, 14, 16 and 22 hours daily, the whole Sky being reckoned as 10.*

1891. Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October	November	December.
1	0·2				1·6	3·8	**10·0**	9·6	**10·0**	1·6	2·2	
2		1·6		2·6	3·0	3·4	9·8	**10·0**	10·0	3·0	0·2	0·8
3		1·4		1·2	0·6	3·6	10·0	10·0	10·0	3·4	1·8	1·4
4					1·0	3·0	10·0	10·0	9·2	3·0	2·8	1·0
5				1·2	1·4	4·4	10·0	10·0	7·4	6·2	1·2	5·0
6				5·6		**2·4**	8·6	10·0	7·8	6·6	1·2	0·4
7				1·6		4·0	9·0	10·0	6·8	3·6	4·4	1·2
8				1·0	0·6	4·2	8·8	10·0	8·0	1·0	**9·0**	3·8
9					1·4	3·6	7·0	9·6	8·2		8·0	
10				1·2	2·4	3·6	7·0	9·2	9·6	0·2	0·6	
11			1·0	0·6	1·6	5·6	5·2	8·6	7·2	0·2		
12			4·2		1·0	6·4	**4·0**	8·8	4·6			
13	1·8	0·6	3·4	0·4	2·0	6·0	10·0	8·8	7·6	0·4		
14	**2·0**		1·6	3·0	5·2	2·8	9·6	10·0	**3·0**	4·4		
15		0·2		7·0	6·2	2·6	9·2	8·8	4·6			
16	0·6	0·2		6·4	3·8	2·4	9·8	9·0	6·6	2·2	1·0	
17			1·6		2·6	3·0	10·0	**7·2**	8·4	5·0		
18			**5·6**	0·8	1·8	5·4	10·0	9·0	8·8	5·0	0·4	
19	0·4	**5·4**	4·0	3·4	2·6	4·4	10·0	7·8	9·8	2·6	1·6	
20	1·6	3·0	0·6	**7·2**	3·2	7·6	10·0	9·2	7·0	2·2		
21		3·4		5·8	6·0	5·8	10·0	8·8	5·0			1·0
22		4·2	2·0	1·8	5·8	8·2	10·0	7·6	7·0	1·2		0·4
23		0·2	0·4	1·0	6·8	6·4	10·0	7·6	6·0	**7·0**		**6·6**
24	0·2		0·6	0·8	5·8	7·2	10·0	8·4	9·6	0·8		0·4
25		0·4	0·2	1·4	**8·4**	9·4	10·0	8·4	10·0	1·8		
26			0·6	0·8	3·4	5·6	10·0	9·8	9·8	2·0		
27			2·6	0·8	6·0	8·6	10·0	10·0	8·8	0·2		
28		0·2	0·4	1·0	4·6	**10·0**	10·0	8·2	6·6	1·0		
29			3·4	1·0	4·4	9·0	10·0	7·8	7·2	0·4		0·4
30			2·6	1·2	3·4	10·0	9·0	7·6	5·8	0·8		0·6
31			2·0		4·2		10·0	10·0		2·4		
Monthly Mean.	**0·2**	0·7	1·2	2·0	3·3	5·4	**9·3**	9·0	7·7	2·2	1·1	0·7
Annual Variation.	−3·4	−2·9	−2·4	−1·6	−0·3	+1·8	+5·7	+5·4	+4·1	−1·4	−2·5	−2·9

For the days which have no entry, 0·0 is to be understood.

Mean of the months from January to April, November and December ... ... 1·0

Mean of the months from May to October ... ... 6·1

Mean for the year ... ... 3·6

Rainfall, 1891.

TABLE XVIII.—*Total Fall of Rain (in inches) as measured by Newman's Gauge, placed 4½ feet above the ground.*

1891. Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
			in.			in.	in.	in.	in.	in.		
1							0·33	0·04	5·82			
2							0·96	0·02	2·14			
3							1·58	0·46	0·97			
4							0·62	1·43	0·56			
5							3·90	0·12	0·26	0·32		
6							0·31		0·64			
7						0·09	0·29	0·08	0·09	0·71		
8						0·17	1·25	0·04	2·77			
9							0·10	0·17	0·20			
10						0·07	0·04	0·10	0·18			
11								0·12				
12			0·20			0·02		0·16				
13								0·04	0·03			
14							0·01	0·01	0·01			
15							0·01	0·01	0·16			
16							0·92	0·09	0·21			
17							0·59	0·11	0·32			
18							5·23	0·12	0·78			
19							1·01	0·21	1·48			
20							0·72	0·45				
21						1·04	1·74	0·77				
22						0·63	0·10	0·07	0·04			
23						2·89	1·60	0·03	0·09			
24						0·02	1·87	0·11	1·60			
25						0·24	1·19		2·30			
26						0·02	3·27	0·10	0·17			
27						1·07	4·28	0·37	0·50			
28						4·78	0·39	0·80	1·06			
29						2·68	0·02	0·42				
30						0·27	0·13	0·24	0·15			
31							0·02	0·25		0·01		
Monthly Total.			0·20			13·99	32·48	6·94	22·53	1·04		
Number of rainy days...			1			14	28	29	25	3		

Total fall of rain in the year ... ... 77·18 inches.
Total number of rainy days in the year 100
The greatest daily fall of rain in the year (that of 1st September) was ... ... 5·82 inches.
No rain fell in the months of January, February, April, May, November and December, nor on any of the days left blank in the above table. ...

Extent of Cloudy Sky, 1892.

TABLE XIX.—*Means of Estimations made at 6, 10, 14, 16 and 22 hours daily, the whole Sky being reckoned as 10.*

1892.	MONTH.											
Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1			0·4	0·4	2·8	5·4	8·2	10·0	10·0	10·0	4·4	
2			0·8	0·2	2·0	7·4	7·4	8·8	10·0	8·6	2·2	
3		0·8	1·4	3·8	3·2	5·2	8·6	9·8	10·0	3·0		0·2
4	0·4			2·4	0·8	8·2	7·8	8·2	10·0	2·2	0·8	
5	0·8			0·4	0·6	9·4	7·8	10·0	10·0	4·2	1·4	
6	0·8	5·8			2·6	8·2	7·0	8·8	10·0	2·6	0·2	
7	0·4	2·8		2·8	2·0	9·8	9·4	10·0	7·6	1·2	1·0	3·4
8	3·4			3·2	2·0	9·4	9·6	9·8	8·0	1·4	0·2	1·6
9	1·4			1·0	2·6	8·8	10·0	7·0	7·0	0·4	0·8	0·8
10	0·2	2·4			3·0	9·0	10·0	10·0	8·0	0·8	1·4	2·6
11					2·4	7·0	10·0	10·0	10·0	1·0	2·0	2·0
12		0·6		0·6	2·2	8·8	9·8	10·0	8·4	1·4	2·2	6·6
13		0·4		1·4	2·2	6·4	10·0	9·6	8·2	1·8	0·4	5·8
14			0·4	2·4	1·6	6·2	9·8	9·2	6·6	3·8	2·8	6·8
15			0·4	2·4	2·2	5·4	6·8	9·6	4·2	2·6		2·4
16			2·8	3·8	3·4	7·8	8·4	9·8	7·0	1·2		2·0
17	0·6		0·4	7·6	3·0	6·6	9·8	10·0	10·0	7·6		1·2
18	1·4	0·8	1·6	8·4	2·6	3·6	10·0	8·0	10·0	8·0		2·2
19		0·4	0·4	7·6	0·6	1·2	10·0	5·6	10·0	4·2		3·2
20		0·2	0·8	3·4	4·2	6·6	9·6	8·8	6·6	5·8		0·4
21	2·8		0·8	1·0	3·4	8·6	10·0	10·0	7·4	6·8		
22	1·4			2·2	3·6	9·6	9·8	7·4	10·0	9·0	0·4	
23			1·2		3·0	9·0	9·0	7·2	6·8	9·4		
24	1·0		0·6	0·4	3·2	4·6	10·0	8·0	6·2	8·0		
25	0·8				2·6	5·0	10·0	9·2	6·6	5·0		1·0
26	5·2	1·4		4·0	4·4	4·8	7·6	10·0	7·6	7·4		0·4
27	3·6	0·4	0·8	2·6	8·2	7·0	9·0	10·0	5·4	6·2		
28			3·2	2·2	6·6	4·0	8·6	10·0	1·0	4·0		3·8
29	0·8		1·8	1·4	6·8	7·4	10·0	10·0	2·0	6·4		4·0
30			1·8	4·0	2·4	4·0	9·2	10·0	4·0	3·2		1·2
31	0·4		0·6		8·0		10·0	10·0		4·6		
Monthly Mean.	0·8	0·6	0·7	2·3	3·2	6·8	9·1	9·2	7·6	4·6	0·7	1·7
Annual Variation ...	—3·1	—3·3	—3·2	—1·6	—0·7	+2·9	+5·2	+5·3	+3·7	+0·7	—3·2	—2·2

For the days which have no entry, 0·0 is to be understood.

Mean of the months from January to April, November and December ... ... 1·1

Mean of the months from May to October ... ... 6·7

Mean for the year ... ... 3·9

Rainfall, 1892.

TABLE XX.—*Total Fall of Rain (in inches) as measured by Newman's Gauge, placed 4½ feet above the ground.*

1892. Date.	MONTH. January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November	December.
					in.	in.	in.	in.	in.	in.	in.	
1					0·11		0·66	1·21	5·21	0·59	0·67	
2						0·08	0·17	0·13	3·60			
3						0·37	0·01	0·05	2·72			
4						0·01		0·17	0·44			
5						0·21		0·25	0·08			
6						1·52	0·50	0·24	0·22			
7						0·81	2·70	1·35	0·10			
8						2·37	1·81	1·16	0·28			
9						0·16	2·49	0·24	0·05			
10						0·23	2·27	0·72				
11							1·50	1·06	0·09			
12							0·16	0·51	0·21			
13						0·44	0·51	2·26	0·22			
14						0·10	0·17	0·86	0·13			
15						0·06	0·18	0·39	0·01			
16						0·75	0·06	0·79	0·05			
17						0·26	2·18	3·76	1·66			
18						0·01	0·22	0·58	1·03	0·02		
19						0·01	0·20		0·95			
20						0·12	0·11	0·01	0·18			
21						0·08	0·27	0·04		0·11		
22						3·38	0·09	0·07	1·01	0·53		
23						1·26	0·04	0·01	0·09	0·62		
24							0·56		0·37	0·02		
25						0·90	0·42	0·04	0·03			
26						0·02	0·09	1·99				
27						0·11	0·15	2·97				
28							1·97	4·81				
29						0·03	3·80	4·20				
30						0·01	0·33	1·26				
31							0·24	5·43				
Monthly Total.					0·11	13·30	23·86	36·56	18·73	1·89	0·67	
Number of rainy days...					1	25	29	29	23	6	1	

Total fall of rain in the year ... ... 95·12 inches.
Total number of rainy days in the year 114
The greatest daily fall of rain in the year (that of 31st August) was ... ... 5·43 inches.
No rain fell in the months of January, February, March, April and December, nor on any of the days left blank in the above table.

Maxima and Minima of different Meteorological Elements, 1891 and 1892.

TABLES XXI AND XXII.—*In which are collected the individual observations in each month of the year, which showed the greatest and the least values of the following elements, viz., Height of Barometer corrected for Temperature; Temperature of Air; Pressure of Vapour; and Additional Capacity of Air.*

	Month.	Height of Barometer.			Temperature of Air.			Pressure of Vapour.			Additional Capacity.		
		Greatest.	Least.	Range.	Greatest.	Least.	Range.	Greatest.	Least.	Range.	Greatest.	Least.	Range.
Table XXI, 1891.		in.	in.	in.	°	°	°	in.	in.	in.	in.	in.	in.
	January ...	30·124	29·821	0·303	87·3	63·2	24·1	0·741	0·327	0·414	0·908	0·103	0·805
	February .	·065	·823	·242	84·8	60·3	24·5	·814	·206	·608	·673	·070	·603
	March ...	29·979	·757	·222	85·1	69·7	15·4	·789	·402	·387	·601	·089	·512
	April ...	·972	·721	·251	89·1	73·8	15·3	·922	·547	·375	·612	·095	·517
	May ...	·917	·611	·306	89·3	77·5	11·8	·956	·715	·241	·580	·114	·466
	June ...	·853	·554	·299	90·8	76·6	14·2	1·000	·817	·183	·563	·059	·504
	July ...	·797	·471	·326	86·9	73·7	13·2	·029	·704	·325	·341	·041	·300
	August ...	·868	·617	·251	84·5	75·4	9·1	0·948	·773	·175	·310	·066	·244
	September.	·910	·620	·290	85·1	74·1	11·0	·982	·734	·248	·337	·039	·298
	October ...	30·001	·716	·285	89·9	75·0	14·9	1·015	·589	·426	·843	·070	·773
	November.	·061	·729	·332	90·2	69·8	20·4	0·986	·426	·560	·910	·090	·820
	December.	·128	·852	·276	87·2	68·2	19·0	·832	·347	·485	·864	·108	·756
	Year ...	30·128	29·471	0·657	90·8	60·3	30·5	1·029	0·206	0·823	0·910	0·039	0·871
Table XXII, 1892.													
	January ...	30·066	29·797	0·269	88·1	64·4	23·7	0·807	0·314	0·493	0·804	0·073	0·731
	February .	·041	·748	·293	87·4	67·2	20·2	·868	·298	·570	·855	·098	·757
	March ...	·014	·666	·348	89·9	67·2	22·7	1·014	·355	·659	·686	·057	·629
	April ...	29·936	·551	·385	92·0	76·9	15·1	·038	·691	·347	·735	·070	·665
	May ...	·917	·450	·467	93·9	80·3	13·6	·050	·674	·376	·835	·161	·674
	June ...	·809	·438	·371	90·0	76·4	13·6	·016	·799	·217	·492	·045	·447
	July ...	·759	·418	·341	88·8	74·8	14·0	·029	·802	·227	·362	·049	·313
	August ...	·819	·578	·241	84·8	74·3	10·5	0·951	·751	·200	·303	·033	·270
	September.	·924	·546	·378	84·2	74·2	10·0	·962	·764	·198	·351	·033	·318
	October ...	·987	·621	·366	91·0	76·0	15·0	1·001	·561	·440	·877	·049	·828
	November.	30·063	·712	·351	86·9	70·2	16·7	0·913	·375	·538	·819	·067	·752
	December.	·084	·855	·229	86·2	68·2	18·0	·871	·430	·441	·737	·092	·645
	Year ...	30·084	29·418	0·666	93·9	64·4	29·5	1·050	0·298	0·752	0·877	0·033	0·844

Temperature of the Ground, 1891 and 1892.

TABLES XXIII AND XXIV.—*Showing, for each Month, the Mean Temperature of the Ground, and its Annual Variation, at the respective depths of 1, 9, 20, 60 and 132 inches below the surface.*

	Depth.	1 Inch.		9 Inches.		20 Inches.		60 Inches.		132 Inches.	
	Month.	Mean Temperature.	Excess over the yearly Mean.	Mean Temperature.	Excess over the yearly Mean.	Mean Temperature.	Excess over the yearly Mean.	Mean Temperature.	Excess over the yearly Mean.	Mean Temperature.	Excess over the yearly Mean.
Table XXIII., 1891.		°	°	°	°	°	°	°	°	°	°
	January ...	76·8	−4·9	77·0	−4·5	80·1	−3·3	82·6	−1·5	82·6	−0·9
	February ...	**76·2**	−5·5	**76·3**	−5·2	**78·9**	−4·5	**81·6**	−2·5	82·1	−1·4
	March ...	80·0	−1·7	79·3	−2·2	80·7	−2·7	81·6	−2·5	**81·9**	−1·6
	April... ...	83·3	+1·6	82·3	+0·8	83·0	−0·4	82·7	−1·4	82·1	−1·4
	May	86·0	+4·3	84·8	+3·3	85·4	+2·0	84·4	+0·3	82·9	−0·6
	June... ...	**87·3**	+5·6	**86·6**	+5·1	**87·5**	+4·1	86·1	+2·0	84·0	+0·5
	July	82·4	+0·7	83·4	+1·9	86·0	+2·6	**86·6**	+2·5	84·7	+1·2
	August ...	82·3	+0·6	82·6	+1·1	84·7	+1·3	85·5	+1·4	**85·0**	+1·5
	September ...	81·7	0·0	81·9	+0·4	84·0	+0·6	84·7	+0·6	84·6	+1·1
	October ...	83·6	+1·9	82·8	+1·3	84·2	+0·8	84·5	+0·4	84·3	+0·8
	November ...	81·8	+0·1	81·6	+0·1	84·0	+0·6	84·5	+0·4	83·8	+0·3
	December ...	79·6	−2·1	79·3	−2·2	82·1	−1·3	83·9	−0·2	83·6	+0·1
	Year ...	81·7		81·5		83·4		84·1		83·5	
Table XXIV., 1892.											
	January ...	**77·8**	−4·1	**78·2**	−3·7	80·9	−2·8	83·0	−1·4	83·1	−0·5
	February ...	79·7	−2·2	79·5	−2·4	81·5	−2·2	82·7	−1·7	82·7	−0·9
	March ...	81·3	−0·6	80·7	−1·2	9 81·	−1·8	82·8	−1·6	82·7	−0·9
	April... ...	86·9	+5·0	85·5	+3·6	85·6	+1·9	84·4	0·0	83·2	−0·4
	May	**87·9**	+6·0	**86·9**	+5·0	**87·5**	+3·8	86·1	+1·7	84·0	+0·4
	June... ...	84·3	+2·4	84·8	+2·9	87·1	+3·4	**87·0**	+2·6	84·8	+1·2
	July	83·0	+1·1	83·9	+2·0	86·2	+2·5	86·8	+2·4	**85·3**	+1·7
	August ...	80·6	−1·3	81·7	−0·2	84·4	+0·7	85·6	+1·2	85·2	+1·6
	September ...	80·2	−1·7	80·7	−1·2	82·8	−0·9	84·2	−0·2	84·2	+0·6
	October ...	83·0	+1·1	82·4	+0·5	83·6	−0·1	83·4	−1·0	83·2	−0·4
	November ...	80·1	−1·8	80·1	−1·8	82·7	−1·0	83·4	−1·0	82·6	−1·0
	December ...	78·0	−3·9	78·2	−3·7	**80·8**	−2·9	**82·6**	−1·8	**82·4**	−1·2
	Year ...	81·9		81·9		83·7		84·4		83·6	

Table XXV.—Five-day Means, 1891.

Number of Five-day Period.	Barometric Pressure.	Temperature of the Air.	Pressure of Vapour.	Additional Capacity of the Air.	*Rainfall.	North or South Component of Wind.	East or West Component of Wind.	Number of Five-day Period.	Barometric Pressure.	Temperature of the Air.	Pressure of Vapour.	Additional Capacity of the Air.	*Rainfall.	North or South Component of Wind.	East or West Component of Wind.
	In.	°	In.	In.	In.	Miles.	Miles.		In.	°	In.	In.	In.	Miles.	Miles.
1	29·996	75·0	0·569	0·308		4·8 N.	2·1 E.	38	29·690	82·0	0·932	0·160	5·85	7·3 S.	18·8 W.
2	·956	73·9	·577	·266		5·8 N.	0·5 E.	39	·696	83·2	·925	·211	0·05	2·1 S.	11·7 W.
3	·954	75·3	·608	·277		3·7 N.	0·5 E.	40	·685	80·5	·893	·152	7·76	2·9 S.	14·5 W.
4	·964	72·7	·544	·266		9·7 N.	2·3 W.	41	·605	79·0	·883	·109	6·03	4·0 S.	14·1 W.
5	·936	71·6	·521	·258		8·3 N.	0·8 W.	42	·614	79·4	·885	·119	9·15	7·6 S.	24·0 W.
6	·914	75·6	·588	·309		6·8 N.	0·7 E.	43	·718	80·6	·892	·150	0·67	7·3 S.	16·9 W.
7	·898	73·2	·549	·280		8·7 N.	1·5 W.	44	·679	80·1	·886	·143	1·67	8·0 S.	16·8 W.
8	·951	69·2	·363	·357		15·8 N.	3·6 W.	45	·766	80·1	·864	·164	0·59	3·4 S.	16·1 W.
9	·972	72·2	·530	·268		10·5 N.	2·9 W.	46	·792	81·0	·867	·190	0·34	3·4 S.	15·4 W.
10	·951	75·5	·601	·288		6·6 N.	1·7 W.	47	·776	80·5	·860	·181	1·53	0·3 N.	13·3 W.
11	·933	75·2	·671	·206		5·1 N.	3·0 W.	48	·758	80·5	·872	·169	1·38	1·4 S.	13·8 W.
12	·908	77·1	·670	·266		5·2 N.	2·9 W.	49	·727	79·3	·878	·125	8·87	0·3 S.	9·1 W.
13	·872	78·5	·694	·285		7·5 N.	5·6 W.	50	·780	79·3	·865	·137	2·52	6·5 S.	7·1 W.
14	·882	77·0	·657	·275		3·1 N.	4·4 W.	51	·797	79·8	·836	·182	3·15	1·8 S	12·2 W.
15	·871	75·5	·574	·312	0·20	8·2 N.	6·8 W.	52	·818	80·6	·845	·203	0·73	2·7 S.	10·2 W.
16	·864	78·3	·619	·355		12·3 N.	6·3 W.	53	·793	79·9	·853	·170	2·30	2·9 S.	7·5 W.
17	·866	78·0	·642	·324		8·0 N.	6·1 W.	54	·781	80·2	·902	·129	4·66	1·7 N.	8·3 W.
18	·845	79·1	·688	·309		11·4 N.	7·1 W.	55	·857	80·1	·869	·163	1·21	1·9 N.	3·1 W.
19	·817	79·5	·733	·277		9·2 N.	6·5 W.	56	·868	80·7	·861	·191	1·03	3·6 N.	0·9 E.
20	·855	80·4	·775	·267		6·0 N.	6·3 W.	57	·858	82·3	·814	·296		6·4 N.	2·9 E.
21	·845	80·4	·837	·203		5·0 N.	6·7 W.	58	·848	81·2	·777	·295		5·8 N.	0·8 E.
22	·829	82·6	·830	·290		5·3 N.	5·6 W.	59	·836	81·1	·779	·288		6·6 N.	3·1 E.
23	·833	81·4	·831	·245		0·1 N.	6·5 W.	60	·845	81·8	·826	·266		2·2 N.	0·0
24	·830	82·0	·854	·242		3·1 N.	6·8 W.	61	·900	82·1	·806	·298	0·01	4·4 N.	0·2 W.
25	·835	82·4	·856	·254		8·7 N.	7·7 W.	62	·832	80·9	·632	·430		8·3 N.	3·5 E.
26	·799	82·6	·850	·270		7·3 N.	8·0 W.	63	·879	82·3	·816	·292		3·3 N.	0·2 W.
27	·772	83·1	·896	·240		5·6 N.	9·6 W.	64	·879	79·5	·670	·345		5·3 N.	1·8 E.
28	·789	84·1	·880	·291		6·1 N.	9·1 W.	65	·905	78·1	·608	·362		6·0 N.	2·0 E.
29	·702	84·6	·861	·328		0·2 N.	8·9 W.	66	·932	76·3	·572	·342		5·7 N.	1·9 E.
30	·703	85·1	·890	·318		2·1 S.	8·8 W.	67	·972	78·0	·646	·321		5·9 N.	1·7 E.
31	·769	85·8	·910	·325		1·2 N.	10·7 W.	68	·958	77·0	·636	·302		5·3 N.	1·2 E.
32	·762	86·4	·956	·304	0·26	3·3 S.	12·8 W.	69	·958	76·7	·667	·358		8·2 N.	5·2 E.
33	·747	85·9	·937	·306	0·09	1·3 S.	13·1 W.	70	·941	76·0	·568	·339		6·6 N.	3·4 E.
34	·748	86·0	·875	·370		3·2 N.	8·3 W.	71	·952	76·1	·598	·311		6·1 N.	2·3 E.
35	·718	85·0	·936	·271	4·58	8·3 S.	3·8 W.	72	·995	78·0	·622	·343		5·9 N.	2·5 E.
36	·693	81·7	·905	·181	8·79	9·0 S.	6·6 W.	73	·956	76·1	·528	·381		7·1 N.	4·7 E.
37	·584	80·4	·899	·136	3·76	9·9 S.	10·2 W.								

* Five-day sums, *not means*.

Table XXVI.—Five-day Means, 1892.

Number of Five-day Period.	Barometric pressure.	Temperature of the Air.	Pressure of Vapour.	Additional capacity of the Air.	Rainfall.*	North or South Component of Wind.	East or West Component of Wind.	Number of Five-day Period.	Barometric pressure.	Temperature of the Air.	Pressure of Vapour.	Additional Capacity of the Air.	Rainfall.*	North or South Component of Wind.	East or West Component of Wind.
	In.	°	In.	In.	In.	Miles.	Miles.		In.	°	In.	In.	In.	Miles.	Miles
1	29·910	76·0	0·609	0·297		3·9 N	2·0 E	38	**29·530**	82·3	0·938	0·167	7·50	13·3 S	4·7 W
2	·892	76·1	·640	·265		5·4 N	1·9 W	39	·588	81·3	·901	·167	4·61	10·2 S	**23·2 W**
3	·893	**73·9**	**·564**	·276		7·9 N	1·8 W	40	·661	81·0	·895	·162	2·84	9·4 S	19·2 W
4	·935	74·7	·565	·302		6·5 N	1·1 W	41	·629	81·1	·890	·170	1·07	7·9 S	18·9 W
5	**·981**	74·7	·629	·237		5·8 N	1·3 W	42	·628	79·7	·874	·142	6·43	5·8 S	15·1 W
6	·959	77·5	·706	·242		2·3 N	0·5 W	43	·654	79·6	·870	·141	1·96	4·8 S	16·1 W
7	·933	78·5	·682	·300		3·6 N	0·4 W	44	·701	79·5	·870	·137	3·17	6·7 S	13·0 W
8	·846	79·0	·767	·227		0·9 S	2·5 W	45	·746	79·1	·876	·120	4·79	1·9 S	12·2 W
9	·887	76·1	·623	·280		6·8 N	3·0 W	46	·734	78·4	·867	·106	6·38	2·6 S	7·1 W
10	·887	76·9	·609	·325		7·1 N	1·8 W	47	·662	80·6	·866	·179	0·13	2·5 S	8·2 W
11	·829	77·2	·605	·335		9·6 N	4·0 W	48	·646	79·3	·882	·121	9·81	2·2 N	9·8 W
12	·816	76·3	·564	·348		**10·8 N**	5·1 W	49	·664	76·2	·840	**·062**	**19·70**	2·3 N	14·8 W
13	·904	75·0	·568	·307		8·2 N	4·1 W	50	·700	78·5	·857	·117	3·56	2·3 S	17·5 W
14	·840	76·8	·663	·264		8·3 N	5·5 W	51	·715	79·2	·831	·165	0·63	1·2 S	10·7 W
15	·776	79·1	·819	·178		3·3 S	3·6 W	52	·818	78·8	·831	·154	2·07	1·0 S	4·0 W
16	·788	80·4	·807	·233		0·2 N	4·4 W	53	·726	78·1	·871	·090	3·17	0·6 S	2·6 W
17	·772	81·5	·820	·259		4·1 N	6·2 W	54	·750	79·9	·887	·136	0·49	1·2 S	5·6 W
18	·788	82·2	·871	·233		8·6 S	4·9 W	55	·816	79·7	·832	·185	0·59	1·1 N	3·1 W
19	·838	83·4	·862	·287		0·3 S	5·0 W	56	·882	81·1	·899	·166		4·8 N	2·1 W
20	·767	85·1	·900	·311		3·4 S	5·1 W	57	·841	81·9	·893	·205		5·0 N	1·7 W
21	·730	84·3	·893	·288		1·0 N	5·5 W	58	·791	83·0	·812	·323		4·6 N	1·8 E
22	·726	85·2	·928	·286		0·7 N	6·8 W	59	·752	80·7	·888	·162	0·66	1·3 S	0·4 W
23	·693	85·8	·904	·335		3·9 N	7·5 W	60	·733	80·2	·868	·164	0·64	2·0 S	0·6 W
24	·810	85·9	·891	·349		7·5 S	7·0 W	61	·753	80·9	·879	·177	0·67	2·1 S	0·6 W
25	·792	86·4	·848	**·419**	0·11	8·5 N	7·3 W	62	·856	79·6	·727	·286		5·4 N	0·3 W
26	·770	85·8	·889	·342		5·2 S	6·8 W	63	·898	79·4	·658	·353		5·1 N	2·3 E
27	·800	85·0	·854	·353		2·0 N	8·2 W	64	·955	78·1	·604	·367		5·5 N	**4·3 E**
28	·778	84·7	·843	·352		3·1 N	9·2 W	65	·909	76·7	·619	·309		4·8 N	2·8 E
29	·706	**86·5**	·909	·354		4·8 S	10·4 W	66	·887	76·8	·655	·271		5·3 N	1·5 E
30	·723	85·7	·897	·344		2·9 N	8·9 W	67	·919	76·8	·582	·346		4·8 N	3·6 E
31	·621	83·4	·890	·258	0·46	8·2 S	0·3 W	68	·979	75·6	·592	·393		5·5 N	3·6 E
32	·579	80·8	·910	·140	5·07	5·6 S	3·5 W	69	·955	75·1	·639	·238		4·3 N	1·0 E
33	·634	82·2	·936	·165	0·77	**14·7 S**	2·6 W	70	·954	75·5	·650	·236		2·4 N	1·2 E
34	·724	82·3	·924	·179	1·09	8·8 S	2·6 W	71	·970	78·0	·710	·255		5·1 N	1·0 E
35	·711	82·6	·930	·187	4·84	4·3 S	3·0 W	72	·974	74·6	·614	·249		3·2 N	0·5 E
36	·655	83·7	·936	·221	1·06	5·4 S	3·8 W	73	·976	75·5	·658	·229		4·4 N	0·1 E
37	·597	84·1	**·975**	·194	0·85	6·3 S	0·1 W								

*Five-day sums, *not means.*

TABLES OF RESULTS

OF

ABSOLUTE MAGNETICAL OBSERVATIONS,

1891 AND 1892.

LIBRARY OF THE BOMBAY BRANCH OF THE ROYAL ASIATIC SOCIETY

B 260—1

Absolute Magnetical Observations.—Table I.

Observations of Vibration and Deflection, taken with the Kew Unifilar Magnetometer (No. 23, by Elliott Brothers), for the determination of Absolute Horizontal Force.

1891.

1891. Date.	Civil Time, Mean.	Magnet N. 23 a. Time of one Vibration.	Effect of 90° Torsion.	Temperature.	Rate of Chronometer.	Corresponding Mean Reading of L. H. F. Magnetometer. Scale Reading.	Thermometer.	Angle of Deflection of Magnet N. 23 c by N. 23 a at Distance. 0·8 foot.	1·0 foot.	Temperature.	Corresponding Mean Reading of L. H. F. Magnetometer. Scale Reading.	Thermometer.	Observer.	Calculated Results in English Units. Values of m.	Values of X. From Deflections at distance. 0·8 foot ($X_{0\cdot8}$)	1·0 foot ($X_{1\cdot0}$)	Difference. $X_{0\cdot8} - X_{1\cdot0}$	Mean. $\frac{X_{0\cdot8}+X_{1\cdot0}}{2}$	Monthly Mean Values of X.	Monthly Mean Values of X in Metrical Units.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
	h. m.	s.	Sc. div.	°	s.		°	° ′ ″	° ′ ″	°		°								
JANUARY 7	12 16	2·8336	0·59	84·7	+12·5	16·60	79·9	17 32 9	8 54 33	84·6	16·36	80·5	G.S.J.	·63985	8·1262	8·1268	−·0006	8·1265		
„ „	15 23	2·8351	0·66	86·3	+12·5	15·95	81·9	17 32 12	8 54 36	86·0	16·09	81·4	G.S.J.	·63984	8·1218	8·1221	−·0003	8·1219		
„ 14	12 7	2·8332	0·74	86·1	+10·8	16·71	81·1	17 31 19	8 54 13	86·0	16·36	81·7	G.S.J.	·63982	8·1300	8·1300	·0000	8·1300		
„ „	15 21	2·8366	0·71	86·9	+10·8	15·29	83·9	17 31 59	8 54 35	87·1	15·67	83·0	G.S.J.	·63965	8·1175	8·1171	+·0004	8·1173	8·1223	3·7450
„ 21	12 10	2·8337	0·72	79·3	+11·9	16·39	76·5	17 34 57	8 56 6	79·0	16·24	77·2	G.S.J.	·63997	8·1160	8·1152	+·0008	8·1156		
„ „	15 14	2·8338	0·66	80·0	+11·9	16·05	79·1	17 34 31	8 55 53	80·0	16·13	78·5	G.S.J.	·63996	8·1169	8·1163	+·0006	8·1166		
„ 28	12 27	2·8335	0·71	83·9	+10·2	16·62	79·9	17 32 10	8 54 40	83·9	16·43	80·5	V.G.G.	·63979	8·1261	8·1259	+·0002	8·1260		
„ „	15 26	2·8340	0·72	83·7	+10·2	16·02	82·0	17 31 55	8 54 35	84·8	16·14	81·5	V.G.G.	·63975	8·1246	8·1238	+·0008	8·1242		
FEBRUARY 4	12 15	2·8319	0·77	76·9	+10·5	17·56	72·9	17 34 12	8 55 42	77·6	17·47	73·8	G.S.J.	·63990	8·1227	8·1223	+·0004	8·1225		
„ „	15 22	2·8323	0·78	77·4	+10·5	16·93	76·7	17 34 5	8 55 37	78·6	17·19	75·6	G.S.J.	·63990	8·1216	8·1214	+·0002	8·1215		
„ 11	12 14	2·8327	0·82	80·0	+10·7	17·25	76·0	17 33 47	8 55 25	80·0	16·78	77·1	V.G.G.	·63978	8·1225	8·1225	·0000	8·1225		
„ „	15 15	2·8328	0·83	78·9	+10·7	16·56	79·1	17 33 12	8 55 5	80·1	16·65	78·5	V.G.G.	·63965	8·1233	8·1236	−·0003	8·1234	8·1220	3·7449
„ 18	12 17	2·8347	0·73	85·1	+ 9·3	16·59	79·8	17 32 35	8 54 51	84·1	16·26	80·3	G.S.J.	·63966	8·1218	8·1218	·0000	8·1218		
„ „	15 25	2·8361	0·69	84·2	+ 9·3	15·66	81·9	17 32 59	8 55 5	83·7	15·86	81·3	G.S.J.	·63956	8·1160	8·1158	+·0002	8·1159		
„ 25	12 24	2·8345	0·63	85·1	+ 9·1	16·67	80·2	17 31 25	8 54 20	84·5	16·53	80·9	G.S.J.	·63953	8·1264	8·1259	+·0005	8·1261		
„ „	15 24	2·8353	0·59	84·4	+ 9·1	15·88	82·7	17 31 17	8 54 17	85·8	16·13	82·0	G.S.J.	·63945	8·1229	8·1223	+·0006	8·1226		
MARCH 4	12 1	2·8362	0·62	85·1	+ 9·2	15·70	82·1	17 31 42	8 54 31	85·2	15·89	82·8	G.S.J.	·63945	8·1199	8·1190	+·0009	8·1194		
„ „	15 0	2·8373	0·57	85·2	+ 9·2	14·97	84·2	17 32 26	8 54 51	85·8	15·35	83·8	G.S.J.	·63947	8·1135	8·1130	+·0005	8·1132		
„ 11	12 9	2·8356	0·58	85·3	+10·1	16·45	81·8	17 31 17	8 54 12	85·6	16·26	82·3	V.G.G.	·63929	8·1233	8·1233	·0000	8·1233		
„ „	15 22	2·8362	0·52	86·0	+10·1	15·49	83·6	17 31 30	8 54 17	86·6	15·85	83·0	V.G.G.	·63951	8·1203	8·1204	−·0001	8·1203		
„ 18	12 17	2·8353	0·61	85·3	+10·7	16·19	81·8	17 31 30	8 54 20	85·2	16·14	82·4	G.S.J.	·63947	8·1236	8·1234	+·0002	8·1235	8·1185	3·7433
„ „	15 28	2·8364	0·66	84·6	+10·7	15·37	83·7	17 32 22	8 54 47	85·8	15·41	83·2	G.S.J.	·63944	8·1160	8·1152	+·0008	8·1156		
„ 25	12 22	2·8354	0·57	85·5	+ 9·7	16·27	82·0	17 31 49	8 54 34	85·1	16·02	82·2	G.S.J.	·63944	8·1223	8·1216	+·0007	8·1219		
„ „	15 28	2·8374	0·59	85·4	+ 9·7	15·12	83·1	17 33 2	8 55 7	85·9	15·29	82·9	G.S.J.	·63957	8·1113	8·1109	+·0004	8·1111		

1891.		Magnet N. 23 *a*.				Corresponding Mean Reading of L. H. F. Magnetometer.		Angle of Deflection of Magnet N. 23 *c* by N. 23 *a* at			Corresponding Mean Reading of L. H. F. Magnetometer.		Observer.	Calculated Results in English Units.						
								Distance.						Values of X.						
Date.	Civil Time, Mean.	Time of one Vibration.	Effect of 90° Torsion.	Temperature.	Rate of Chronometer.	Scale Reading.	Thermometer.	0·8 foot.	1·0 foot.	Temperature.	Scale Reading.	Thermometer.		Values of m.	From Deflections at distance.		Difference.	Mean.	Monthly Mean Values of X.	Monthly Mean Values of X in Metrical Units.
															0·8 foot ($X_{0\cdot8}$)	1·0 foot ($X_{1\cdot0}$)	$X_{0\cdot8} - X_{1\cdot0}$	$\frac{X_{0\cdot8} + X_{1\cdot0}}{2}$		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
	h. m.	s.	Sc. div.	°	s.		°	° ′ ″	° ′ ″	°		°								
April 1	12 5	2·8365	0·56	84·9	+9·8	15·65	83·0	17 32 57	8 55 6	84·7	15·37	83·5	G. S. J.	·63947	8·1150	8·1143	+·0007	8·1146		
„ „	15 11	2·8379	0·54	84·3	+9·8	14·72	84·3	17 33 35	8 55 27	85·1	14·78	84·0	G. S. J.	·63944	8·1077	8·1068	+·0009	8·1072		
„ 8	12 9	2·8378	0·55	87·9	+8·6	15·50	83·9	17 31 22	8 54 17	87·3	15·27	84·2	V. G. G.	·63909	8·1171	8·1167	+·0004	8·1169		
„ „	15 19	2·8382	0·51	86·2	+8·6	14·19	85·1	17 32 40	8 54 53	87·8	14·39	84·9	V. G. G.	·63947	8·1094	8·1094	·0000	8·1094		
„ 15	12 21	2·8362	0·52	87·1	+7·8	15·43	84·9	17 31 58	8 54 37	86·1	15·10	85·0	G. S. J.	·63943	8·1199	8·1191	+·0008	8·1195		
„ „	15 24	2·8378	0·53	85·7	+7·8	14·58	85·6	17 32 19	8 54 45	87·1	14·67	85·4	G. S. J.	·63931	8·1119	8·1115	+·0004	8·1117	8·1159	3·7421
„ 22	12 17	2·8372	0·55	90·0	+8·6	15·42	85·0	17 30 15	8 53 40	89·4	15·27	85·3	V. G. G.	·63920	8·1231	8·1231	·0000	8·1231		
„ „	15 18	2·8378	0·52	87·2	+8·6	14·56	86·0	17 31 0	8 54 5	90·0	14·97	85·6	V. G. G.	·63938	8·1156	8·1152	+·0004	8·1154		
„ 29	12 13	2·8363	0·51	87·8	+8·3	15·57	85·6	17 30 32	8 53 55	88·5	15·35	85·9	G. S. J.	·63928	8·1234	8·1227	+·0007	8·1230		
„ „	15 25	2·8378	0·50	88·0	+8·3	14·63	86·9	17 30 16	8 53 50	89·9	15·02	86·5	G. S. J.	·63923	8·1191	8·1180	+·0011	8·1185		
May 6	12 15	2·8366	0·51	88·0	+8·9	15·79	85·3	17 29 32	8 53 32	88·7	15·68	86·0	V. G. G.	·63906	8·1264	8·1247	+·0017	8·1255		
„ „	15 17	2·8377	0·51	88·2	+8·9	14·62	86·4	17 29 45	8 53 40	89·5	15·31	86·4	V. G. G.	·63929	8·1218	8·1201	+·0017	8·1209		
„ 13	12 12	2·8374	0·51	90·4	+8·1	15·24	86·6	17 29 30	8 53 32	90·7	15·24	87·0	G. S. J.	·63922	8·1244	8·1227	+·0017	8·1235		
„ „	15 24	2·8376	0·50	88·0	+8·1	14·78	88·0	17 29 31	8 53 30	91·1	15·08	87·8	G. S. J.	·63913	8·1214	8·1199	+·0015	8·1206	8·1206	3·7442
„ 20	12 8	2·8380	0·52	91·8	+8·2	14·73	87·2	17 30 7	8 53 45	92·2	14·58	87·6	V. G. G.	·63937	8·1201	8·1191	+·0010	8·1196		
„ „	15 17	2·8383	0·52	90·3	+8·2	14·07	88·6	17 30 37	8 53 57	92·4	14·27	88·1	V. G. G.	·63944	8·1158	8·1152	+·0006	8·1155		
„ 27	12 19	2·8379	0·53	92·4	+8·9	14·83	88·6	17 29 42	8 53 26	92·7	14·70	89·0	G. S. J.	·63932	8·1221	8·1219	+·0002	8·1220		
„ „	15 25	2·8390	0·54	91·0	+8·9	14·35	89·7	17 29 54	8 53 30	92·7	14·54	89·4	G. S. J.	·63913	8·1169	8·1169	·0000	8·1169		
June 3	12 44	2·8392	0·53	93·9	+8·3	14·74	89·4	17 28 52	8 53 0	94·5	14·60	90·0	V. G. G.	·63901	8·1208	8·1208	·0000	8·1208		
„ „	15 11	2·8394	0·53	93·0	+8·3	14·30	90·6	17 28 22	8 52 46	94·5	14·52	90·0	V. G. G.	·63893	8·1204	8·1204	·0000	8·1204		
„ 10	12 17	2·8380	0·53	92·8	+7·9	15·02	89·1	17 28 56	8 53 2	93·4	14·87	89·6	G. S. J.	·63913	8·1244	8·1242	+·0002	8·1243		
„ „	15 25	2·8394	0·56	92·5	+7·9	14·20	90·3	17 29 11	8 53 11	94·0	14·50	90·0	G. S. J.	·63906	8·1184	8·1180	+·0004	8·1182		
„ 17	12 16	2·8389	0·59	93·5	+9·3	14·81	89·1	17 28 50	8 53 2	93·9	14·80	89·6	V. G. G.	·63907	8·1223	8·1218	+·0005	8·1220	8·1208	3·7443
„ „	15 21	2·8393	0·56	92·0	+9·3	14·02	90·4	17 29 30	8 53 27	95·2	14·29	90·1	V. G. G.	·63929	8·1161	8·1150	+·0011	8·1155		
„ 24	12 11	2·8372	0·51	90·9	+8·4	15·25	87·1	17 29 12	8 53 16	91·1	15·32	87·5	G. S. J.	·63923	8·1261	8·1253	+·0008	8·1257		
„ „	15 27	2·8392	0·48	91·2	+8·4	14·50	88·4	17 29 13	8 53 14	91·8	15·11	88·1	G. S. J.	·63906	8·1199	8·1195	+·0004	8·1197		
July 1	12 16	2·8356	0·48	85·7	+6·2	16·01	83·1	17 29 22	8 53 17	86·6	15·99	83·3	V. G. G.	·63888	8·1296	8·1294	+·0002	8·1295		
„ „	15 18	2·8362	0·47	86·0	+6·2	15·53	83·9	17 29 37	8 53 25	87·6	15·73	83·7	V. G. G.	·63898	8·1262	8·1259	+·0003	8·1260		
„ 8	12 27	2·8375	0·48	86·5	+6·8	15·31	83·8	17 30 35	8 53 57	88·1	15·21	84·2	D.	·63895	8·1190	8·1182	+·0008	8·1186		
„ „	15 27	2·8380	0·44	87·7	+6·8	14·67	85·1	17 30 42	8 54 0	88·2	14·95	84·7	D.	·63912	8·1182	8·1175	+·0007	8·1178		
„ 15	12 25	2·8373	0·45	88·3	+7·2	15·12	85·8	17 30 25	8 53 52	89·4	15·03	85·9	V. G. G.	·63916	8·1206	8·1199	+·0007	8·1202		
„ „	15 20	2·8387	0·43	90·1	+7·2	14·63	87·0	17 29 40	8 53 27	90·5	14·91	86·6	V. G. G.	·63897	8·1201	8·1195	+·0006	8·1198	8·1223	3·7450
„ 22	12 36	2·8362	0·49	85·9	+7·3	16·03	82·9	17 29 42	8 53 27	86·2	15·95	83·1	D.	·63879	8·1272	8·1268	+·0004	8·1270		
„ „	15 22	2·8368	0·46	81·7	+7·3	15·34	82·2	17 30 17	8 53 47	85·2	15·70	82·8	D.	·63873	8·1206	8·1201	+·0005	8·1203		
„ 29	12 29	2·8362	0·44	85·1	+7·4	16·04	82·1	17 30 2	8 53 39	85·8	15·83	82·9	V. G. G.	·63881	8·1257	8·1251	+·0006	8·1254		
„ „	15 17	2·8379	0·46	85·3	+7·4	15·16	83·2	17 30 26	8 53 50	86·3	15·53	83·0	V. G. G.	·63881	8·1190	8·1186	+·0004	8·1188		

August	6	12	14	2·8366	0·52	85·8	+7·1	15·55	83·0	17	30	30	8	53	50	85·6	15·34	83·5	D.	·63884	8·1234	8·1233	+·0001	8·1233		
	„	„	15	37	2·8376	0·50	85·1	+7·1	14·68	84·0	17	30	50	8	54	2	86·6	14·90	84·0	D.	·63894	8·1178	8·1175	+·0003	8·1176		
	„	12	12	24	2·8369	0·47	86·2	+6·9	15·51	83·1	17	30	32	8	53	52	86·0	15·44	83·5	V. G. G.	·63891	8·1225	8·1223	+·0002	8·1224		
	„	„	15	21	2·8387	0·47	85·9	+6·9	14·41	84·0	17	31	15	8	54	12	86·4	14·91	83·8	V. G. G.	·63895	8·1141	8·1139	+·0002	8·1140		
	„	20	12	5	2·8370	0·46	86·0	+6·3	15·37	83·9	17	30	37	8	53	55	86·9	15·12	84·2	D.	·63888	8·1208	8·1204	+·0004	8·1206	8·1194	3·7431
	„	„	15	38	2·8377	0·52	85·4	+6·3	14·75	83·8	17	31	15	8	54	17	85·7	14·84	84·1	D.	·63894	8·1169	8·1161	+·0008	8·1165		
	„	27	12	20	2·8370	0·49	84·8	+6·7	15·36	83·1	17	30	30	8	53	57	85·4	15·29	83·4	V. G. G.	·63876	8·1218	8·1206	+·0012	8·1212		
	„	„	15	17	2·8375	0·47	85·1	+6·7	15·01	84·2	17	30	20	8	53	52	86·4	15·11	84·2	V. G. G.	·63875	8·1201	8·1191	+·0010	8·1196		
Sept.	2	12	6	2·8378	0·46	82·0	+6·0	15·27	80·7	17	31	16	8	54	25	83·0	15·04	81·2	D.	·63841	8·1163	8·1147	+·0016	8·1155		
	„	„	15	33	2·8383	0·42	82·9	+6·0	14·60	81·6	17	32	0	8	54	50	83·4	14·71	81·6	D.	·63873	8·1126	8·1105	+·0021	8·1115		
	„	9	12	14	2·8377	0·46	85·8	+6·5	15·48	82·0	17	30	22	8	54	5	85·6	15·27	82·4	V. G. G.	·63865	8·1208	8·1182	+·0026	8·1195		
	„	„	15	20	2·8392	0·44	84·4	+6·5	14·43	83·0	17	30	54	8	54	22	86·6	14·77	82·9	V. G. G.	·63869	8·1124	8·1096	+·0028	8·1110		
	„	16	12	14	2·8379	0·48	87·4	+7·3	15·16	84·1	17	29	30	8	53	42	87·6	14·96	84·5	D.	·63862	8·1231	8·1201	+·0030	8·1216		
	„	„	15	15	2·8384	0·53	87·0	+7·3	14·56	85·0	17	30	0	8	53	57	88·3	14·71	84·9	D.	·63882	8·1190	8·1160	+·0030	8·1175	8·1168	3·7425
	„	23	12	18	2·8373	0·51	88·0	+7·1	15·61	84·1	17	29	12	8	53	35	87·9	15·40	84·4	V. G. G.	·63872	8·1261	8·1229	+·0032	8·1245		
	„	„	15	23	2·8395	0·49	87·8	+7·1	13·96	85·1	17	29	57	8	53	57	88·6	14·60	84·9	V. G. G.	·63887	8·1163	8·1132	+·0031	8·1147		
	„	30	12	10	2·8384	0·56	86·1	+6·7	14·96	83·1	17	29	55	8	53	55	87·0	14·89	83·6	D.	·63857	8·1193	8·1163	+·0030	8·1178		
	„	„	15	10	2·8392	0·50	86·4	+6·7	14·14	84·2	17	30	12	8	54	5	87·5	14·56	84·2	D.	·63873	8·1158	8·1126	+·0032	8·1142		
Oct.	7	12	9	2·8378	0·44	90·0	+6·3	15·53	85·1	17	28	41	8	53	18	89·9	15·25	85·7	V. G. G.	·63872	8·1268	8.1238	+·0030	8·1253		
	„	„	15	21	2·8392	0·45	88·9	+6·3	14·44	86·8	17	29	22	8	53	37	90·3	14·85	86·4	V. G. G.	·63881	8·1186	8·1158	+·0028	8·1172		
	„	14	12	18	2·8378	0·53	89·2	+8·3	15·41	85·1	17	29	22	8	53	35	88·0	15·17	85·6	G.S. J.	·63872	8·1251	8·1227	+·0024	8·1239		
	„	„	15	23	2·8386	0·60	87·4	+8·3	14·61	86·0	17	29	50	8	53	46	88·9	14·78	85·8	G. S. J.	·63876	8·1188	8·1165	+·0023	8·1176		
	„	21	11	49	2·8381	0·58	89·6	+8·5	15·15	86·0	17	28	47	8	53	15	89·2	15·09	86·3	V. G. G.	·63865	8·1257	8·1234	+·0023	8·1245	8·1197	3·7438
	„	„	15	4	2·8384	0·56	86·4	+8·5	14·51	87·0	17	29	47	8	53	47	89·4	14·75	87·0	V. G. G.	·63882	8·1182	8·1158	+·0024	8·1170		
	„	28	12	14	2·8394	0·55	92·0	+9·2	14·77	87·3	17	29	4	8	53	22	91·6	14·56	87·7	G. S. J.	·63872	8·1208	8·1188	+·0020	8·1198		
	„	„	15	19	2·8400	0·56	88·8	+9·2	13·90	88·4	17	30	7	8	53	50	91·1	14·11	88·1	G. S. J.	·63878	8·1128	8·1113	+·0015	8·1120		
Nov.	4	12	7	2·8377	0·60	89·5	+10·6	15·57	85·1	17	29	5	8	53	18	88·7	15·35	85·8	V. G. G.	·63872	8·1262	8·1247	+·0015	8·1254		
	„		15	24	2·8388	0·60	86·9	+10 6	14·52	87·2	17	29	57	8	53	42	88·7	14·86	86·8	V. G. G.	·63875	8·1176	8·1163	+·0013	8·1169		
	„	11	12	3	2·8375	0·56	89·0	+8·3	15·40	86·9	17	28	21	8	52	58	90·4	15·21	87·2	D.	·63862	8·1272	8·1255	+·0017	8·1263		
	„	„	15	24	2·8387	0·55	88·9	+8·3	14·51	88·6	17	28	52	8	53	11	91·3	14·76	88·1	D.	·63870	8·1210	8·1197	+·0013	8·1203		
	„	18	12	9	2·8374	0·57	87·4	+10·1	15 80	83·0	17	29	25	8	53	27	87·4	15·62	83·7	V. G. G.	·63868	8·1251	8·1236	+·0015	8·1243	8·1211	3·7445
	„	„	15	13	2·8385	0·55	86·1	+10·1	15·02	85·6	17	29	32	8	53	29	88·2	15·35	85·0	V. G. G.	·63857	8·1199	8·1186	+·0013	8·1192		
	„	25	12	21	2·8374	0·61	85·5	+9·9	16·22	81·5	17	30	15	8	53	52	85·0	16·01	82·0	D.	·63857	8·1225	8·1212	+·0013	8·1218		
	„	„	15	28	2·8384	0·62	84·4	+9·9	15·31	83·4	17	31	10	8	54	17	84·8	15·59	82·9	D.	·63869	8·1156	8·1145	+·0011	8·1150		
Dec.	2	12	42	2·8370	0·58	87·5	+9·7	16·34	83·5	17	28	50	8	53	10	87·8	16·17	84·1	V. G. G.	·63863	8·1281	8·1266	+·0015	8·1273		
	„	„	15	8	2·8381	0·59	86·0	+9·7	15·33	85·9	17	29	14	8	53	20	89·8	15·68	84·6	V. G. G.	·63863	8·1204	8·1191	+·0013	8·1197		
	„	9	12	20	2·8376	0·62	84·9	+10·2	16·09	80·8	17	29	46	8	53	39	85·2	15·99	81·2	D.	·63843	8·1231	8·1216	+·0015	8·1223		
	„	„	15	24	2·8383	0·62	84·8	+10·2	15·33	84·0	17	29	20	8	53	27	87·3	15·81	82·4	D.	·63843	8·1206	8·1190	+·0016	8·1198		
	„	16	12	14	2·8373	0·67	85·5	+9·8	16·60	80·5	17	29	17	8	53	25	85·7	16·39	81·2	V. G. G.	·63838	8·1257	8·1240	+·0017	8·1248		
	„	„	15	18	2·8386	0·66	86·1	+9·8	15·48	83·1	17	29	35	8	53	35	87·3	15·89	82·1	V. G. G.	·63853	8·1201	8·1182	+·0019	8·1191	8·1231	3·7454
	„	23	12	24	2·8373	0·69	88·4	+9·9	15·99	82·9	17	29	15	8	53	25	87·6	15·80	83·5	D.	·63870	8·1264	8·1246	+·0018	8·1255		
	„	„	15	35	2·8383	0·69	88·1	+9·9	15·05	85·3	17	29	7	8	53	20	88·7	15·47	84·7	D.	·63870	8·1229	8·1214	+·0015	8·1221		
	„	30	12	20	2·8368	0·68	84·4	+10·6	17·01	80·5	17	28	45	8	53	12	85 3	16·70	81·1	V. G. G.	·63819	8·1287	8·1266	+·0021	8·1276		
	„	„	15	27	2 8377	0·67	86·0	+10·6	16·31	82·9	17	29	12	8	53	25	87·7	16·41	81·9	V. G. G.	·63850	8·1234	8·1216	+·0018	8·1225		
The mean value of the Horizontal Force for the year 1891 =																						8·1202				3·7441

Absolute Magnetical Observations.—Table II.

Observations of Absolute Declination.

1891.

1891. Date.	Bombay Civil Time.	Mean Readings. Collimator Magnet. Scale apparently Erect.	Collimator Magnet. Scale apparently Inverted.	Horizontal Circle with Telescope pointed to: Scale of Collimator Magnet.	Horizontal Circle with Telescope pointed to: Tárdeo Chimney.	Torsion. Mean.	Torsion. Effect of 90.°	Observer.	Corresponding Reading of large Declination Magnetometer.	Absolute Easterly Declination corrected for Torsion.	Monthly Mean. Corresponding Reading of large Declination Magnetometer.	Monthly Mean. Absolute Easterly Declination.
1	2	3	4	5	6	7	8	9	10	11	12	13
	h. m.	Sc. div.	Sc. div.	° ′ ″	° ′ ″	°	Sc. div.		Sc. div.	° ′ ″	Sc. div.	° ′ ″
JAN. 1	11 51	+1·55	+1·57	17 12 0	196 52 40	0		G.S.J.	35·38	0 45 45		
„ 8	11 29	+1·52	+1·59	17 14 30	196 53 10	15 E	0·85	G.S.J.	35·65	0 47 22		
„ 15	11 27	+1·47	+1·70	17 11 55	196 53 0	0		G.S.J.	35·32	0 45 6	35·49	0 46 22
„ 22	11 29	+1·50	+1·64	17 14 10	196 53 20	0		G.S.J.	35·61	0 47 6		
„ 29	11 32	+1·51	+1·65	17 13 45	196 53 32	0		V.G.G.	35·50	0 46 29		
FEB. 5	11 20	+1·52	+1·55	17 13 57	196 53 42	0		G.S.J.	35·52	0 46 40		
„ 12	11 39	+1·52	+1·60	17 13 30	196 53 40	0		V.G.G.	35·45	0 46 10		
„ 19	11 29	+1·51	+1·62	17 12 50	196 53 20	0		G.S.J.	35·38	0 45 49	35·45	0 46 16
„ 26	11 43	+1·47	+1·71	17 14 15	196 54 0	0		G.S.J.	35·45	0 46 24		
MARCH 5	11 28	+1·50	+1·65	17 12 35	196 52 57	0		G.S.J.	35·39	0 45 54		
„ 12	11 40	+1·50	+1·66	17 14 30	196 53 25	0		V.G.G.	35·59	0 47 20		
„ 19	11 36	+1·42	+1·76	17 12 42	196 52 55	0		G.S.J.	35·39	0 45 50	35·43	0 46 8
„ 26	11 38	+1·50	+1·61	17 12 30	196 53 20	0		G.S.J.	35·36	0 45 29		
APRIL 2	11 22	+1·47	+1·70	17 12 50	196 52 40	0		G.S.J.	35·48	0 46 21		
„ 9	11 43	+1·52	+1·64	17 10 55	196 52 45	0		V.G.G.	35·19	0 44 28		
„ 16	11 40	+1·50	+1·65	17 11 25	196 52 40	0		G.S.J.	35·27	0 45 1	35·25	0 44 54
„ 23	11 41	+1·51	+1·65	17 10 10	196 52 40	0		V.G.G.	35·06	0 43 46		
„ 30	11 36	+1·50	+1·65	17 10 55	196 52 15	0		G.S.J.	35·26	0 44 56		
MAY 7	11 32	+1·59	+1·49	17 8 30	196 52 45	0		V.G.G.	34·86	0 42 18		
„ 14	11 19	+1·52	+1·57	17 10 20	196 52 5	0		G.S.J.	35·20	0 44 38		
„ 21	11 40	+1·51	+1·61	17 10 10	196 52 30	0		V.G.G.	35·11	0 43 59	35·02	0 43 24
„ 28	11 26	+1·52	+1·59	17 8 20	196 52 0	0		G.S.J.	34·90	0 42 42		
JUNE 4	11 33	+1·51	+1·67	17 8 20	196 52 0	0		V.G.G.	34·89	0 42 35		
„ 11	11 22	+1·52	+1·60	17 10 40	196 51 25	5 E	0·74	G.S.J.	35·30	0 45 29		
„ 18	11 36	+1·52	+1·65	17 8 30	196 52 0	0		V.G.G.	34·91	0 42 48	35·02	0 43 33
„ 25	11 10	+1·52	+1·62	17 8 30	196 51 30	0		G.S.J.	34·99	0 43 19		
JULY 2	11 29	+1·52	+1·62	17 9 40	196 52 0	0		V.G.G.	35·08	0 43 59		
„ 9	11 51	+1·52	+1·71	17 8 40	196 52 10	0		D.	34·90	0 42 44		
„ 16	11 34	+1·52	+1·64	17 10 55	196 52 30	0		V.G.G.	35·21	0 44 43	35·05	0 43 43
„ 23	11 32	+1·51	+1·75	17 10 0	196 53 0	0		D.	34·97	0 43 9		
„ 30	11 41	+1·51	+1·67	17 10 0	196 52 15	0		V.G.G.	35·09	0 44 0		
AUG. 7	11 34	+1·51	+1·71	17 8 50	196 51 20	5 E	0·72	D.	35·02	0 43 37		
„ 13	11 34	+1·49	+1·70	17 9 10	196 51 30	0		V.G.G.	35·04	0 43 52	34·94	0 43 13
„ 21	11 14	+1·49	+1·67	17 9 0	196 52 0	0		D.	34·94	0 43 14		
„ 28	11 34	+1·47	+1·72	17 8 0	196 52 0	0		V.G.G.	34·76	0 42 9		
SEPT. 3	11 34	+1·46	+1·69	17 6 40	196 51 15	0		D.	34·69	0 41 36		
„ 10	11 40	+1·51	+1·65	17 8 20	196 51 15	0		V.G.G.	34·95	0 43 21	34·83	0 42 33
„ 17	11 16	+1·55	+1·57	17 7 30	196 51 0	0		D.	34·89	0 42 55		
„ 24	11 32	+1·51	+1·67	17 7 0	196 50 55	0		V.G.G.	34·80	0 42 20		
OCT. 1	11 51	+1·51	+1·61	17 7 50	196 50 52	0		G.S.J.	34·96	0 43 17		
„ 8	11 42	+1·45	+1·75	17 6 5	196 50 0	0		V.G.G.	34·81	0 42 10		
„ 15	11 27	+1·45	+1·81	17 9 10	196 50 37	0		G.S.J.	35·15	0 44 34	35·02	0 43 44
„ 22	11 40	+1·54	+1·59	17 9 40	196 51 30	0		V.G.G.	35·14	0 44 33		
„ 29	11 16	+1·45	+1·74	17 9 20	196 51 20	0		G.S.J.	35·06	0 44 7		
NOV. 5	11 29	+1·57	+1·54	17 8 40	196 51 10	0		V.G.G.	35·02	0 43 57		
„ 12	11 33	+1·52	+1·62	17 10 5	196 51 15	5 W	0·75	D.	35·24	0 45 15		
„ 19	11 35	+1·50	+1·61	17 9 25	196 52 10	0		V.G.G.	35·00	0 43 34	35·13	0 44 34
„ 26	11 31	+1·51	+1·62	17 11 0	196 51 50	0		D.	35·28	0 45 29		
DEC. 3	11 33	+1·55	+1·54	17 10 40	196 52 35	0		V.G.G.	35·15	0 44 31		
„ 10	11 33	+1·52	+1·64	17 11 0	196 52 0	0		D.	35·29	0 45 18		
„ 17	11 26	+1·52	+1·62	17 10 25	196 52 0	0		V.G.G.	35·22	0 44 44	35·23	0 44 53
„ 24	11 28	+1·51	+1·60	17 10 2	196 52 10	0		C.	35·13	0 44 12		
„ 31	12 4	+1·59	+1·57	17 11 27	196 52 15	0		D.	35·34	0 45 39		

The Mean Declination for the year 1891 = 0 44 26

Absolute Magnetical Observations.—Table III.

OBSERVATIONS OF INCLINATION, 1891.

Taken with Barrow's Dip Circle, with Microscopes, No. 49 and two 3½-inch Needles, Nos. 1 and 2, by Dover, Charlton.

1891. Date.	Bombay Civil Time (0 to 24 hours). At commencement.	At conclusion.	Observer.	Needle marked.	End of Needle Dipping. A. Face of Circle. East.	A. Face of Circle. West.	B. Face of Circle. East.	B. Face of Circle. West.	Mean Dip.	Monthly Mean for each Needle.	Monthly Mean.
	h. m.	h. m.			° ′	° ′	° ′	° ′	° ′		° ′
JAN. 2	14 22	15 46	C.	1	20 42·6	21 0·2	19 54·5	20 13·1	20 27·6		
„ 6	12 10	13 30	G.S.J.	1	20 43·1	20 54·1	19 59·9	20 13·2	20 27·6	No. 1 20 26·9	
„ 9	14 39	16 0	G.S.J.	2	20 34·9	20 47·9	20 8·6	20 20·0	20 27·8		
„ 12	12 26	13 48	G.S.J.	2	20 33·9	20 46·4	20 5·6	20 17·6	20 25·9		
„ 16	14 36	15 58	G.S.J.	1	20 43·2	20 54·3	20 0·1	20 11·2	20 27·2		20 26·9
„ 20	12 21	13 45	G.S.J.	1	20 40·9	20 56·6	19 58·7	20 11·2	20 26·8	No. 2 20 26·8	
„ 23	14 44	16 5	G.S.J.	2	20 33·6	20 48·6	20 6·6	20 21·7	20 27·6		
„ 27	12 15	13 45	V.G.G.	2	20 35·0	20 50·2	19 56·7	20 22·0	20 26·0		
„ 30	14 52	16 20	V.G.G.	1	20 41·0	20 59·4	19 52·7	20 7·6	20 25·2		
FEB. 3	12 25	13 48	G.S.J.	1	20 45·3	20 57·4	19 57·6	20 11·2	20 27·9		
„ 6	14 40	16 2	G.S.J.	2	20 31·4	20 47·9	20 9·5	20 21·5	20 27·6	No. 1 20 28·4	
„ 10	12 25	13 45	V.G.G.	2	20 31·1	20 52·5	20 0·5	20 23·1	20 26·8		
„ 13	14 55	16 25	V.G.G.	1	20 47·9	20 57·9	19 56·2	20 7·5	20 27·4		20 28·0
„ 17	12 20	13 42	G.S.J.	1	20 47·6	20 55·6	20 2·7	20 13·0	20 29·7		
„ 20	14 43	16 5	G.S.J.	2	20 37·9	20 43·5	20 12·4	20 23·1	20 29·2	No. 2 20 27·7	
„ 24	12 26	13 50	V.G.G.	2	20 40·9	20 46·5	20 5·7	20 15·5	20 27·1		
„ 27	14 45	16 9	G.S.J.	1	20 45·1	20 53·2	20 4·9	20 11·4	20 28·6		
MAR. 3	12 18	13 41	G.S.J.	1	20 44·9	20 50·3	20 6·7	20 9·5	20 27·8		
„ 6	14 50	16 14	G.S.J.	2	20 35·1	20 51·1	20 4·0	20 25·1	20 28·8	No. 1 20 27·6	
„ 10	12 28	13 50	V.G.G.	2	20 33·2	20 51·7	20 2·4	20 24·4	20 27·9		
„ 13	14 53	16 35	V.G.G.	1	20 49·1	20 57·4	19 49·7	20 13·0	20 27·3		20 28·0
„ 17	12 21	13 40	G.S.J.	1	20 46·7	20 53·3	20 4·1	20 10·7	20 28·7		
„ 20	14 45	16 7	G.S.J.	2	20 39·9	20 44·9	20 12·9	20 16·3	20 28·5	No. 2 20 28·5	
„ 24	12 23	13 46	G.S.J.	2	20 40·8	20 44·7	20 12·1	20 18·0	20 28·9		
„ 27	14 48	16 8	V.G.G.	1	20 41·7	20 52·4	20 7·0	20 7·9	20 27·2		
„ 31	12 0	13 16	C.	1	20 42·0	20 56·9	20 1·7	20 7·0	20 26·9		
APRIL 3	14 51	16 12	G.S.J.	2	20 42·6	20 45·1	20 13·6	20 14·6	20 29·0		
„ 7	12 25	13 44	V.G.G.	2	20 47·6	20 42·2	20 6·9	20 9·2	20 26·5	No. 1 20 26·0	
„ 10	14 50	16 10	V.G.G.	1	20 40·5	20 51·9	20 3·7	20 6·9	20 25·7		
„ 14	12 12	13 36	G.S.J.	1	20 46·5	20 53·2	20 4·6	20 10·2	20 28·6		20 27·1
„ 18	14 50	16 13	G.S.J.	2	20 43·4	20 46·5	20 12·8	20 14·9	20 29·4	No. 2 20 28·2	
„ 21	12 25	13 52	V.G.G.	2	20 44·4	20 41·7	20 14·7	20 11·2	20 28·0		
„ 24	14 53	16 18	V.G.G.	1	20 44·0	20 56·1	19 56·5	20 7·5	20 26·0		
„ 28	12 19	13 42	G.S.J.	1	20 40·7	20 55·7	19 56·8	20 2·0	20 23·8		

1891. Date.	Bombay Civil Time (0 to 24 hours). At commencement.	At conclusion.	Observer.	Needle marked.	End of Needle Dipping. A. Face of Circle. East.	A. Face of Circle. West.	B. Face of Circle. East.	B. Face of Circle. West.	Mean Dip.	Monthly Mean for each Needle.	Monthly Mean.
	h. m.	h. m.			° ′	° ′	° ′	° ′	° ′		° ′
MAY 1	14 52	16 15	G.S.J.	2	20 48·1	20 42·7	20 11·6	20 2·5	20 26·2		
„ 5	12 20	13 42	V.G.G.	2	20 43·5	20 47·0	20 9·1	20 7·5	20 26·8	No. 1 ° ′	
„ 9	14 51	16 14	V.G.G.	1	20 37·7	20 58·7	19 58·1	20 6·0	20 25·1	20 27·0	
„ 12	12 11	13 31	G.S.J.	1	20 46·3	20 54·9	20 4·6	20 7·9	20 28·4		
„ 15	14 44	16 4	G.S.J.	2	20 49·2	20 50·5	20 0·5	20 18·4	20 29·6		20 27·7
„ 19	12 22	13 45	V.G.G.	2	20 47·1	20 52·4	20 0·1	20 19·5	20 29·8		
„ 22	14 52	16 12	V.G.G.	1	20 46·1	20 57·7	20 0·7	20 5·0	20 27·4	No. 2 ° ′	
„ 26	12 24	13 45	G.S.J.	1	20 46·2	20 54·7	20 3·6	20 4·1	20 27·1	20 28·2	
„ 29	14 44	16 3	G.S.J.	2	20 47·2	20 44·0	20 13·5	20 9·4	20 28·5		
JUNE 2	12 25	13 42	V.G.G.	2	20 46·7	20 46·5	20 10·5	20 20·1	20 30·9		
„ 5	14 52	16 12	V.G.G.	1	20 46·0	20 53·7	20 5·7	20 7·1	20 28·1	No. 1 ° ′	
„ 9	12 14	13 39	G.S.J.	1	20 48·4	20 54·4	20 4·7	20 10·1	20 29·4		
„ 12	14 40	16 2	G.S.J.	2	20 44·2	20 47·2	20 14·9	20 11·6	20 29·5	20 28·6	
„ 16	12 24	13 42	V.G.G.	2	20 46·4	20 41·0	20 14·2	20 14·1	20 28·9		20 28·9
„ 19	14 48	16 10	V.G.G.	1	20 52·6	20 52·1	19 57·2	20 8·7	20 27·6	No. 2 ° ′	
„ 23	12 14	13 33	G.S.J.	1	20 47·1	20 55·3	20 4·8	20 10·3	20 29·4		
„ 26	15 2	16 23	G.S.J.	2	20 46·2	20 39·1	20 13·9	20 17·0	20 29·0	20 29·1	
„ 30	12 23	13 39	V.G.G.	2	20 46·9	20 38·5	20 8·9	20 14·6	20 27·2		
JULY 3	14 48	16 15	V.G.G.	1	20 50·6	20 54·4	20 4·0	20 6·0	22 28·7		
„ 7	12 32	14 1	D.	1	20 54·2	20 54·0	20 3·2	20 3·6	20 28·7	No. 1 ° ′	
„ 10	15 11	16 40	D.	2	20 48·7	20 47·9	20 8·6	20 12·7	20 29·5	20 29·1	
„ 14	12 20	13 45	V.G.G.	2	20 40·1	20 41·0	20 15·5	20 11·5	20 27·0		
„ 17	14 52	16 20	V.G.G.	1	20 51·2	20 58·6	20 3·9	20 5·9	20 29·9		20 28·9
„ 21	12 28	14 2	D.	1	20 53·6	20 57·6	20 2·9	20 5·2	20 29·8	No. 2 ° ′	
„ 24	15 30	17 4	D.	2	20 45·1	20 49·5	20 8·2	20 10·7	20 28·4	20 28·6	
„ 28	12 24	13 54	V.G.G.	2	20 51·6	20 54·1	20 4·9	20 7·7	20 29·6		
„ 31	14 54	16 18	V.G.G.	1	20 56·0	20 57·6	19 57·6	20 2·1	20 28·3		
AUG. 4	12 35	14 8	D.	1	20 50·0	21 8·2	19 57·5	20 4·2	20 30·0	No. 1 ° ′	
„ 7	15 23	16 53	D.	2	20 47·0	20 54·7	20 1·0	20 17·7	20 30·1	20 29·4	
„ 11	12 25	13 50	V.G.G.	2	20 47·2	20 53·7	20 4·1	20 11·6	20 29·1		
„ 14	14 55	16 22	V.G.G.	1	20 55·6	21 0·5	19 56·2	19 58·6	20 27·7		20 29·7
„ 18	12 22	13 56	D,	1	20 58·5	21 6·1	19 53·7	20 4·5	20 30·7	No. 2 ° ′	
„ 21	15 12	16 41	D.	2	20 45·1	20 57·5	20 9·5	20 10·5	20 30·6	20 29·9	
„ 25	12 27	13 50	V.G.G.	2	20 42·1	20 55·1	20 8·2	20 14·4	20 29·9		
„ 28	14 54	16 20	V.G.G.	1	20 57·0	21 3·4	19 52·5	20 4·4	20 29·3		

1891. Date.	Bombay Civil Time (0 to 24 hours). At commencement.	At conclusion.	Observer.	Needle marked.	End of Needle Dipping. A. Face of Circle. East.	A. Face of Circle. West.	B. Face of Circle. East.	B. Face of Circle. West.	Mean Dip.	Monthly Mean for each Needle.	Monthly Mean.
	h. m.	h. m.			° ′	° ′	° ′	° ′	° ′		° ′
SEPT. 1	12 7	13 43	D.	1	20 59·4	21 1·4	19 59·4	19 55·1	20 28·8		
„ 4	14 36	16 5	D.	2	20 55·5	20 44·0	20 7·9	20 15·8	20 30·8	No. 1 ° ′	
„ 8	12 24	13 53	V.G.G.	2	20 41·4	20 46·0	20 7·5	20 24·9	20 29·9	20 29·6	
„ 11	14 50	16 15	V.G.G.	1	20 53·7	21 3·0	19 49·1	20 8·5	20 28·6		
„ 15	12 20	13 53	D.	1	20 54·2	20 51·1	20 4·2	20 7·6	20 29·3		20 29·3
„ 18	14 52	16 20	D.	2	20 40·6	20 45·6	20 10·5	20 14·0	20 27·7	No. 2 ° ′	
„ 22	12 25	13 54	V.G.G.	2	20 39·7	20 47·7	20 9·5	20 11·2	20 27·0	20 28·8	
„ 25	15 20	16 51	D.	1	20 53·7	20 59·0	20 1·5	20 5·7	20 30·0		
„ 29	12 19	13 48	D.	1	21 1·4	21 0·0	20 0·0	20 3·7	20 31·3		
OCT. 2	14 37	15 58	G.S.J.	2	20 39·1	20 49·1	20 10·7	20 18·9	20 29·4		
„ 6	12 25	13 53	V.G.G.	2	20 39·5	20 50·2	20 10·6	20 11·0	20 27·8	No. 1 ° ′	
„ 9	14 52	16 20	V.G.G.	1	20 50·1	21 1·0	19 55·6	20 10·1	20 29·2	20 30·2	
„ 13	12 3	13 24	G.S.J.	1	20 48·4	20 57·7	20 2·7	20 15·7	20 31·1		
„ 16	14 56	16 18	G.S.J.	2	20 45·2	20 49·4	20 8·5	20 18·4	20 30·4		20 30·2
„ 20	12 25	13 50	V.G.G.	2	20 38·0	20 51·9	20 8·7	20 24·6	20 30·8	No. 2 ° ′	
„ 23	14 50	16 15	V.G.G.	1	20 47·7	20 56·2	20 3·2	20 10·0	20 29·3	20 30·2	
„ 27	12 14	13 40	G.S.J.	1	20 45·0	21 5·3	20 3·4	20 12·1	20 31·4		
„ 30	14 56	16 17	G.S.J.	2	20 41·2	20 53·6	20 11·4	20 23·6	20 32·4		
NOV. 3	12 25	13 57	V.G.G.	2	20 35·7	20 53·6	20 12·7	20 21·7	20 30·9		
„ 6	14 52	16 20	V.G.G.	1	20 46·4	21 0·7	20 4·0	20 11·7	20 30·7	No. 1 ° ′	
„ 10	12 10	13 35	D.	1	20 52·4	21 1·2	20 6·4	20 11·5	20 32·9	20 31·6	
„ 13	14 57	16 19	D.	2	20 42·5	20 49·2	20 15·5	20 20·7	20 32·0		
„ 17	12 24	13 46	V.G.G.	2	20 37·2	20 50·0	20 18·5	20 21·1	20 31·7		20 31·5
„ 20	14 57	16 22	V.G.G.	1	20 45·6	21 2·0	20 9·2	20 14·2	20 32·7	No 2 ° ′	
„ 24	12 10	13 40	D.	1	20 51·0	21 1·7	19 57·5	20 9·7	20 30·0	20 31·5	
„ 27	14 49	16 15	D.	2	20 46·6	20 52·4	20 11·2	20 15·5	20 31·4		
DEC. 1	12 23	13 48	V.G.G.	2	20 41·1	20 55·2	20 8·2	20 17·0	20 30·4		
„ 4	14 49	16 12	V.G.G	1	20 49·9	20 56·2	20 2·6	20 17·2	20 31·5	No. 1 ° ′	
„ 8	12 9	13 33	D.	1	20 48·9	21 3·7	20 3·7	20 8·0	20 31·1	20 31·2	
„ 11	15 10	16 34	D.	2	20 51·2	20 58·7	20 3·9	20 8·0	20 30·4		
„ 15	12 20	13 43	V.G.G.	2	20 44·2	20 55·9	20 8·1	20 17·2	20 31·3		
„ 18	14 50	16 14	V.G.G.	1	20 50·4	21 3·5	20 1·9	20 8·9	20 31·2	No. 2 ° ′	20 31·0
„ 22	12 20	13 46	D.	1	20 54·2	21 0·6	20 2·7	20 6·7	20 31·0	20 30·8	
„ 25	14 38	15 54	C.	2	20 41·1	20 57·7	20 10·1	20 16·8	20 31·4		
„ 29	12 15	13 34	V.G.G.	2	20 42·5	20 56·2	20 9·5	20 14·2	20 30·6		

The Mean Dip for the year ... { With Needle No. 1 = ° ′ 20 28·8 ; With Needle No. 2 = 20 29·0 }

The Mean Dip for the year 1891 = ° ′ 20 28·9

Absolute Magnetical Observations.—Table III *a*.

SUPPLEMENTARY OBSERVATIONS OF INCLINATION, 1891.

Taken with Barrow's Dip Circle, with Microscopes, No. 49 and two 3½-inch Needles, Nos. $\frac{1}{81}$ and $\frac{2}{81}$, by John Dover.

1891. Date.	Bombay Civil Time (0 to 24 hours). At commencement.	At conclusion.	Observer.	Needle marked.	End of Needle Dipping. A. Face of Circle. East.	A. Face of Circle. West.	B. Face of Circle. East.	B. Face of Circle. West.	Mean Dip.	Monthly Mean for each Needle.	Monthly Mean.
	h. m.	h. m.			° ′	° ′	° ′	° ′	° ′		° ′
JAN. 2	13 30	16 38	C.	$\frac{1}{81}$	20 20·2	20 36·3	20 17·2	20 34·7	20 27·1		
„ 6	11 17	14 29	G.S.J.	$\frac{1}{81}$	20 16·1	20 35·1	20 12·6	20 35·7	20 24·9	No. $\frac{1}{81}$	
„ 9	13 43	16 57	G.S.J.	$\frac{2}{81}$	20 23·7	20 37·4	19 58·0	20 25·5	20 21·1	° ′	
„ 12	11 31	14 46	G.S.J.	$\frac{2}{81}$	20 17·9	20 38·7	20 0·7	20 24·1	20 20·3	20 25·2	
„ 16	13 43	17 2	G.S.J.	$\frac{1}{81}$	20 15·9	20 34·7	20 13·2	20 33·3	20 24·3		20 23·1
„ 20	11 28	14 48	G.S.J.	$\frac{1}{81}$	20 17·9	20 34·7	20 18·3	20 30·1	20 25·2	No. $\frac{2}{81}$	
„ 23	13 49	17 4	G.S.J.	$\frac{2}{81}$	20 24·1	20 34·7	20 0·9	20 20·1	20 19·9	° ′	
„ 27	11 30	14 40	V.G.G.	$\frac{2}{81}$	20 27·6	20 31·7	19 57·6	20 27·4	20 21·1	20 20·6	
„ 30	14 1	17 13	V.G.G.	$\frac{1}{81}$	20 16·6	20 37·1	20 13·7	20 30·2	20 24·4		
FEB. 3	11 28	14 44	G.S.J.	$\frac{1}{81}$	20 17·2	20 35·9	20 19·3	20 31·5	20 26·0		
„ 6	13 45	16 59	G.S.J.	$\frac{2}{81}$	20 24·5	20 29·5	20 10·7	20 25·6	20 22·6	No. $\frac{1}{81}$	
„ 10	11 35	14 38	V.GG.	$\frac{2}{81}$	20 16·0	20 33·0	20 6·7	20 29·9	20 21·4	° ′	
„ 13	14 5	17 20	V.G.G.	$\frac{1}{81}$	20 21·7	20 26·7	20 20·0	20 33·0	20 25·3	20 27·0	
„ 17	11 25	14 39	G.S.J.	$\frac{1}{81}$	20 29·2	20 28·3	20 24·5	20 30·6	20 28·1		20 24·7
„ 20	13 48	17 5	G.S.J.	$\frac{2}{81}$	20 27·2	20 28·8	20 14·1	20 25·6	20 23·9	No. $\frac{2}{81}$	
„ 24	11 35	14 40	V.G.G.	$\frac{2}{81}$	20 31·7	20 21·1	20 10·2	20 24·7	20 21·9	° ′	
„ 27	13 50	17 10	G.S.J.	$\frac{1}{81}$	20 29·2	20 30·5	20 24·6	20 30·4	20 28·7	20 22·4	
MAR. 3	11 25	14 38	G.S.J.	$\frac{1}{81}$	20 30·1	20 30·6	20 27·3	20 30·4	20 29·6		
„ 6	13 55	17 10	G.S.J.	$\frac{2}{81}$	20 22·5	20 43·2	19 54·9	20 25·7	20 21·6	No. $\frac{1}{81}$	
„ 10	11 32	14 42	V.G.G.	$\frac{2}{81}$	20 25·5	20 32·6	19 53·2	20 33·5	20 21·2	° ′	
„ 13	14 0	17 20	V.G.G.	$\frac{1}{81}$	20 28·7	20 32·2	20 21·9	20 31·2	20 28·5	20 28·8	
„ 17	11 26	14 39	G.S.J.	$\frac{1}{81}$	20 29·6	20 28·9	20 32·1	20 29·4	20 30·0		20 26·1
„ 20	13 50	17 5	G.S.J.	$\frac{2}{81}$	20 34·9	20 27·8	20 3·7	20 27·0	20 23·3	No. $\frac{2}{81}$	
„ 24	11 30	14 42	G.S.J.	$\frac{2}{81}$	20 34·7	20 25·1	20 18·7	20 20·1	20 24·6	° ′	
„ 27	13 55	17 1	V.G.G.	$\frac{1}{81}$	20 27·7	20 23·6	20 37·0	20 25·4	20 28·4	20 22·7	
„ 31	11 14	14 10	C.	$\frac{1}{81}$	20 20·4	20 32·0	20 25·1	20 33·1	20 27·6		
APRIL 3	13 55	17 10	G.S.J.	$\frac{2}{81}$	20 37·9	20 30·2	20 13·3	20 12·8	20 23·5		
„ 7	11 25	14 35	V.G.G.	$\frac{2}{81}$	20 27·6	20 31·6	20 12·0	20 16·9	20 22·0	No. $\frac{1}{81}$	
„ 10	13 56	17 2	V.G.G.	$\frac{1}{81}$	20 28·7	20 32·1	20 30·4	20 25·0	20 29·0	° ′	
„ 14	11 20	14 35	G.S.J.	$\frac{1}{81}$	20 26·3	20 26·7	20 28·7	20 31·9	20 28·4	20 28·4	
„ 18	13 55	17 10	G.S.J.	$\frac{2}{81}$	20 37·7	20 26·3	20 16·7	20 22·6	20 25·8		20 26·1
„ 21	11 30	14 48	V.G.G.	$\frac{2}{81}$	20 32·5	20 26·4	20 15·7	20 22·5	20 24·3	No. $\frac{2}{81}$	
„ 24	14 5	17 10	V.G.G.	$\frac{1}{81}$	20 20·7	20 32·5	20 25·4	20 32·6	20 27·8	° ′	
„ 28	11 25	14 41	G.S.J.	$\frac{1}{81}$	20 33·0	20 26·5	20 26·7	20 27·2	20 28·3	20 23·9	

1891. Date.	Bombay Civil Time (0 to 24 hours). At commencement.		At conclusion.		Observer.	Needle marked.	End of Needle Dipping. A. Face of Circle. East.		A. Face of Circle. West.		B. Face of Circle. East.		B. Face of Circle. West.		Mean Dip.	Monthly Mean for each Needle.	Monthly Mean.
	h.	m.	h.	m.			°	′	°	′	°	′	°	′	°	′	°	′
May 1	13	58	17	10	G.S.J.	2/81	20	43·7	20	29·7	20	10·2	20	14·6	20	24·5		
„ 5	11	29	14	33	V.G.G.	2/81	20	35·9	20	30·4	20	17·7	20	16·9	20	25·2	No. 1/81	
„ 9	14	0	17	10	V.G.G.	1/81	20	26·5	20	29·9	20	29·4	20	30·7	20	29·1	20 29·1	
„ 12	11	17	14	30	G.S.J.	1/81	20	29·5	20	29·5	20	30·5	20	27·1	20	29·1		
„ 15	13	50	17	1	G.S.J.	2/81	20	39·9	20	32·1	20	8·7	20	19·9	20	25·1		20 26·6
„ 19	11	32	14	37	V.G.G.	2/81	20	38·5	20	31·1	20	12·0	20	17·2	20	24·7	No. 2/81	
„ 22	13	59	17	5	V.G.G.	1/81	20	29·5	20	34·5	20	29·5	20	19·9	20	28·3	20 24·7	
„ 26	11	30	14	44	G.S.J.	1/81	20	33·2	20	29·9	20	27·1	20	28·9	20	29·8		
„ 29	13	50	17	1	G.S.J.	2/81	20	30·7	20	39·9	20	7·6	20	17·1	20	23·8		
June 2	11	35	14	35	V.G.G.	2/81	20	36·5	20	37·5	20	8·7	20	21·9	20	26·1		
„ 5	13	58	17	6	V.G.G.	1/81	20	34·4	20	25·4	20	30·9	20	30·0	20	30·2	No. 1/81	
„ 9	11	20	14	39	G.S.J.	1/81	20	30·9	20	31·0	20	22·5	20	28·9	20	28·3		
„ 12	13	45	17	3	G.S.J.	2/81	20	44·0	20	32·9	20	8·2	20	23·7	20	27·2	20 28·9	
„ 16	11	32	14	35	V.G.G.	2/81	20	38·9	20	30·5	20	3·7	20	29·0	20	25·5		20 27·1
„ 19	13	58	17	3	V.G.G.	1/81	20	31·9	20	32·5	20	20·6	20	24·0	20	27·2		
„ 23	11	20	14	29	G.S.J.	1/81	20	31·9	20	32·0	20	27·7	20	28·9	20	30·1	No. 2/81	
„ 26	14	10	17	20	G.S.J.	2/81	20	38·6	20	35·9	20	8·7	20	18·9	20	25·5	20 25·7	
„ 30	11	29	14	30	V.G.G.	2/81	20	38·2	20	35·4	20	6·4	20	16·0	20	24·0		
July 3	14	2	17	15	V.G.G.	1/81	20	23·9	20	34·2	20	22·0	20	34·0	20	28·5		
„ 7	11	30	14	59	D.	1/81	20	22·6	20	29·6	20	21·6	20	31·7	20	26·4	No. 1/81	
„ 10	14	15	17	31	D.	2/81	20	37·1	20	34·1	20	7·9	20	21·2	20	25·1		
„ 14	11	29	14	37	V.G.G.	2/81	20	32·6	20	33·6	20	10·4	20	21·7	20	24·6	20 28·2	
„ 17	14	0	17	15	V.G.G.	1/81	20	29·5	20	33·9	20	20·5	20	29·2	20	28·3		20 27·4
„ 21	11	17	14	59	D.	1/81	20	26·7	20	35·6	20	24·1	20	32·0	20	29·6		
„ 24	14	25	18	2	D.	2/81	20	35·1	20	35·1	20	3·4	20	32·7	20	26·6	No. 2/81	
„ 28	11	31	14	47	V.G.G.	2/81	20	35·6	20	31·1	20	13·6	20	36·6	20	29·2	20 26·4	
„ 31	14	4	17	10	V.G.G.	1/81	20	32·5	20	29·9	20	22·1	20	28·6	20	28·3		
Aug. 4	11	35	15	7	D.	1/81	20	31·5	20	29·7	20	21·7	20	33·5	20	29·1		
„ 7	14	24	17	49	D.	2/81	20	33·7	20	36·2	20	9·5	20	40·5	20	30·0	No. 1/81	
„ 11	11	36	14	43	V.G.G.	2/81	20	32·2	20	30·7	20	12·4	20	37·7	20	28·2		
„ 14	14	1	17	15	V.G.G.	1/81	20	29·1	20	32·9	20	20·2	20	27·2	20	27·3	20 29·4	
„ 18	11	24	14	56	D.	1/81	20	23·7	20	33·2	20	31·2	20	34·4	20	30·6		20 29·2
„ 21	14	12	17	38	D.	2/81	20	32·7	20	36·6	20	13·0	20	34·4	20	29·2	No. 2/81	
„ 25	11	32	14	45	V.G.G.	2/81	20	34·4	20	33·6	20	15·2	20	31·7	20	28·7	20 29·0	
„ 28	14	1	17	15	V.G.G.	1/81	20	26·2	20	35·4	20	27·9	20	32·4	20	30·5		

1891. Date.	Bombay Civil Time (0 to 24 hours). At commencement.	At conclusion.	Observer.	Needle marked.	End of Needle Dipping. A. Face of Circle. East.	A. Face of Circle. West.	B. Face of Circle. East.	B. Face of Circle. West.	Mean Dip.	Monthly Mean for each Needle.	Monthly Mean.
	h. m.	h. m.			° ′	° ′	° ′	° ′	° ′		° ′
Sept. 1	11 8	14 41	D.	$\frac{1}{81}$	20 26·4	20 37·2	20 18·6	20 38·7	20 30·2		
„ 4	13 40	17 5	D.	$\frac{2}{81}$	20 39·2	20 31·4	20 15·7	20 30·5	20 29·2	No. $\frac{1}{81}$	
„ 8	11 33	14 45	V.G.G.	$\frac{2}{81}$	20 36·2	20 27·4	20 14·7	20 35·0	20 28·3	° ′	
„ 11	13 55	17 12	V.G.G.	$\frac{1}{81}$	20 28·4	20 37·2	20 17·0	20 36·1	20 29·7	20 30·4	
„ 15	11 21	14 49	D.	$\frac{1}{81}$	20 30·6	20 30·0	20 26·4	20 32·7	20 29·9		20 29·1
„ 18	13 56	17 14	D.	$\frac{2}{81}$	20 37·2	20 26·1	20 7·0	20 33·4	20 25·9	No. $\frac{2}{81}$	
„ 22	11 30	14 45	V.G.G.	$\frac{2}{81}$	20 31·4	20 27·9	20 7·7	20 39·0	20 26·5	° ′	
„ 25	14 25	17 42	D.	$\frac{1}{81}$	20 26·1	20 36·2	20 20·0	20 38·0	20 30·1	20 27·5	
„ 29	11 20	14 53	D.	$\frac{1}{81}$	20 26·7	20 35·5	20 31·4	20 33·9	20 31·9		
Oct. 2	13 45	16 57	G.S.J.	$\frac{2}{81}$	20 34·6	20 35·4	20 11·2	20 25·5	20 26·7		
„ 6	11 32	14 45	V.G.G.	$\frac{2}{81}$	20 31·1	20 30·7	20 5·0	20 37·0	20 25·9	No. $\frac{1}{81}$	
„ 9	13 58	17 15	V.G.G.	$\frac{1}{81}$	20 32·2	20 30·7	20 20·6	20 32·0	20 28·9	° ′	
„ 13	11 12	14 22	G.S.J.	$\frac{1}{81}$	20 28·6	20 32·4	20 18·1	20 43·0	20 30·5	20 29·6	
„ 16	14 3	17 13	G.S.J.	$\frac{2}{81}$	20 33·9	20 31·5	20 22·4	20 27·5	20 28·8		20 28·5
„ 20	11 29	14 40	V.G.G.	$\frac{2}{81}$	20 27·5	20 36·0	20 19·6	20 31·6	20 28·7	No. $\frac{2}{81}$	
„ 23	13 58	17 10	V.G.G.	$\frac{1}{81}$	20 29·5	20 26·5	20 22·9	20 35·1	20 28·5	° ′	
„ 27	11 18	14 33	G.S.J.	$\frac{1}{81}$	20 29·4	20 29·5	20 24·7	20 38·6	20 30·5	20 27·7	
„ 30	13 59	17 12	G.S.J.	$\frac{2}{81}$	20 32·7	20 27·5	20 16·5	20 36·2	20 28·2		
Nov. 3	11 28	14 49	V.G.G.	$\frac{2}{81}$	20 32·9	20 30·5	20 17·9	20 31·7	20 28·2		
„ 6	14 0	17 15	V.G.G.	$\frac{1}{81}$	20 26·5	20 32·6	20 26·7	20 33·6	20 29·8	No. $\frac{1}{81}$	
„ 10	11 16	14 33	D.	$\frac{1}{81}$	20 28·1	20 29·6	20 25·9	20 40·0	20 30·9	° ′	
„ 13	13 55	17 11	D.	$\frac{2}{81}$	20 27·4	20 39·1	20 15·4	20 35·7	20 29·4	20 30·7	
„ 17	11 30	14 36	V.G.G.	$\frac{2}{81}$	20 34·4	20 36·9	20 15·4	20 27·5	20 28·5		20 29·6
„ 20	14 4	17 10	V.G.G.	$\frac{1}{81}$	20 32·6	20 29·9	20 25·7	20 38·4	20 31·6	No. $\frac{2}{81}$	
„ 24	11 15	14 37	D.	$\frac{1}{81}$	20 28·6	20 36·4	20 25·9	20 31·4	20 30·6	° ′	
„ 27	13 55	17 9	D.	$\frac{2}{81}$	20 39·5	20 39·9	20 9·7	20 21·5	20 27·6	20 28·4	
Dec. 1	11 35	14 39	V.G.G.	$\frac{2}{81}$	20 39·1	20 43·9	20 5·4	20 18·7	20 26·8		
„ 4	13 58	17 7	V.G.G.	$\frac{1}{81}$	20 23·9	20 34·6	20 27·2	20 37·7	20 30·8	No. $\frac{1}{81}$	
„ 8	11 13	14 28	D.	$\frac{1}{81}$	20 28·6	20 35·7	20 20·6	20 34·6	20 29·9	° ′	
„ 11	14 15	17 25	D.	$\frac{2}{81}$	20 40·7	20 40·0	20 6·4	20 20·7	20 26·9	20 30·5	
„ 15	11 25	14 39	V.G.G.	$\frac{2}{81}$	20 30·5	20 39·1	20 12·2	20 25·1	20 26·7		20 28·5
„ 18	13 58	17 7	V.G.G.	$\frac{1}{81}$	20 26·4	20 35·9	20 25·9	20 32·9	20 30·3	No. $\frac{2}{81}$	
„ 22	11 26	14 38	D.	$\frac{1}{81}$	20 28·5	20 38·1	20 25·0	20 32·5	20 31·0	° ′	
„ 25	13 52	16 43	C.	$\frac{2}{81}$	20 24·2	20 46·6	20 4·9	20 34·4	20 27·5	20 26·9	
„ 29	11 22	14 28	V.G.G.	$\frac{2}{81}$	20 23·6	20 45·0	20 7·9	20 29·2	20 26·4		

The Mean Dip for the year... { With Needle No. $\frac{1}{81}$ = ° ′ 20 28·8 / With Needle No. $\frac{2}{81}$ = 20 25·5

The Mean Dip for the year 1891 = ° ′ 20 27·2

Absolute Magnetical Observations.—Table IV.

Observations of Vibration and Deflection, taken with the Kew Unifilar Magnetometer (No. 23, by Elliott Brothers), for the determination of Absolute Horizontal Force.

1892.

1892. Date.	Civil Time, Mean.	Magnet N. 23 a. Time of one Vibration.	Effect of 90° Torsion.	Temperature.	Rate of Chronometer.	Corresponding Mean Reading of L. H. F. Magnetometer. Scale Reading.	Thermometer.	Angle of Deflection of Magnet N. 23 c by N. 23 a at Distance. 0·8 foot.	1·0 foot.	Temperature.	Corresponding Mean Reading of L. H. F. Magnetometer. Scale Reading.	Thermometer.	Observer.	Calculated Results in English Units. Values of m.	Values of X. From Deflections at distance. 0·8 foot ($X_{0·8}$)	1·0 foot ($X_{1·0}$)	Difference. $X_{0·8} - X_{1·0}$	Mean. $\frac{X_{0·8} + X_{1·0}}{2}$	Monthly Mean Values of X.	Monthly Mean Values of X in Metrical Units.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
	h. m.	s.	Sc. div.	°	s.		°	° ′ ″	° ′ ″	°		°								
January 6	12 7	2·8400	0·74	86·4	+9·7	15·16	81·3	17 32 12	8 54 50	86·8	14·90	82·0	G.S.J.	·63873	8·1066	8·1053	+·0013	8·1059		
„ „	15 20	2·8408	0·77	85·7	+9·7	14·33	84·4	17 32 9	8 54 51	87·8	14·67	83·6	G.S.J.	·63876	8·1031	8·1014	+·0017	8·1022		
„ 14	12 0	2·8367	0·80	83·0	+10·6	16·90	78·6	17 31 20	8 54 22	82·1	16.61	79·3	G.S.J.	·63863	8·1208	8·1197	+·0011	8·1202		
„ „	15 3	2·8381	0·82	82·2	+10·6	15·92	80·9	17 31 40	8 54 30	82·7	16·11	80·1	G.S.J.	·63850	8·1143	8·1133	+·0010	8·1138	8·1143	3·7413
„ 21	12 12	2·8391	0·74	86·6	+9·8	16·14	81·8	17 29 15	8 53 17	86·7	16·24	82·3	V.G.G.	·63822	8·1206	8·1199	+·0007	8·1202		
„ „	15 19	2·8393	0·79	86·1	+9·8	15·57	84·0	17 29 39	8 53 27	87·4	16·00	83·5	V.G.G.	·63838	8·1175	8·1169	+·0006	8·1172		
„ 27	12 10	2·8385	0·72	87·2	+9·3	16·07	82·3	17 30 11	8 53 45	86·7	15·82	82·9	G.S.J.	·63850	8·1193	8·1186	+·0007	8·1189		
„ „	15 11	2·8393	0·75	87·8	+9·3	15·48	84·1	17 30 4	8 53 41	87·9	15·63	83·7	G.S.J.	·63853	8·1167	8·1161	+·0006	8·1164		
February 3	12 11	2·8390	0·78	87·9	+9·3	15·73	82·8	17 29 53	8 53 37	88·2	15·51	83·4	V.G.G.	·63845	8·1180	8·1173	+·0007	8·1176		
„ „	15 21	2·8398	0·79	87·0	+9·3	14·58	85·8	17 30 10	8 53 47	89·5	14·99	85·0	V.G.G.	·63862	8·1128	8·1119	+·0009	8·1123		
„ 10	12 9	2·8385	0·68	87·9	+9·2	15·81	83·5	17 29 44	8 53 31	87·0	15·73	83·8	G.S.J.	·63850	8·1214	8·1206	+·0008	8·1210		
„ „	15 13	2·8390	0·68	85·5	+9·2	15·29	84·1	17 29 57	8 53 37	87·7	15·43	84·0	G.S.J.	·63841	8·1163	8·1156	+·0007	8·1159	8·1171	3·7426
„ 17	12 12	2·8385	0·71	87·3	+10·5	16·25	80·6	17 29 50	8 53 32	87·2	16·12	81·5	V.G.G.	·63851	8·1204	8·1199	+·0005	8·1201		
„ „	15 15	2·8400	0·68	87·6	+10·5	15·08	84·8	17 30 15	8 53 42	88·7	15·41	83·7	V.G.G.	·63850	8·1135	8·1133	+·0002	8·1134		
„ 24	12 12	2·8370	0·72	84·9	+9·8	16·75	79·6	17 29 56	8 53 35	85·4	16·35	80·9	G.S.J.	·63848	8·1238	8·1234	+·0004	8·1236		
„ „	15 17	2·8392	0·76	84·1	+9·8	15·18	83·6	17 30 47	8 54 3	85·9	15·61	82·9	G.S.J.	·63848	8·1130	8·1122	+·0008	8·1126		
March 2	12 16	2·8392	0·78	84·1	+9·0	15·52	81·1	17 32 0	8 54 42	84·5	15·22	81·5	V.G.G.	·63847	8·1098	8·1087	+·0011	8·1092		
„ „	15 23	2·8396	0·77	82·1	+9·0	14·66	82·4	17 32 10	8 54 47	84·5	15·17	82·0	V.G.G.	·63863	8·1062	8·1051	+·0011	8·1056		
„ 9	12 24	2·8383	0·75	82·4	+9·2	15·63	80·8	17 32 2	8 54 41	82·3	15·59	81·1	G.S.J.	·63851	8·1128	8·1119	+·0009	8·1123		
„ „	15 11	2·8400	0·68	82·2	+9·2	14·69	82·2	17 32 34	8 54 59	82·9	15·09	82·0	G.S.J.	·63853	8·1053	8·1042	+·0011	8·1047		
„ 16	12 7	2·8396	0·65	88·1	+7·0	15·29	84·4	17 30 15	8 53 50	88·4	15·05	84·9	V.G.G.	·63845	8·1150	8·1139	+·0011	8·1144	8·1133	3·7409
„ „	15 17	2·8402	0·66	88·1	+7·0	14·33	85·7	17 30 25	8 53 55	88·8	14·61	85·4	V.G.G.	·63859	8·1122	8·1111	+·0011	8·1116		
„ 23	12 9	2·8385	0·57	88·8	+8·3	15·99	84·5	17 28 31	8 53 1	88·7	15·81	84·9	G.S.J.	·63832	8·1253	8·1238	+·0015	8·1245		
„ „	15 10	2·8398	0·60	88·5	+8·3	14·88	85·8	17 29 12	8 53 17	89·0	15·30	85·5	G.S.J.	·63844	8·1184	8·1175	+·0009	8·1179		
„ 30	12 17	2·8397	0·63	89·8	+7·7	15·09	85·4	17 29 22	8 53 24	89·5	15·05	85·8	V.G.G.	·63847	8·1186	8·1175	+·0011	8·1180		
„ „	15 26	2·8402	0·64	89·3	+7·7	14·51	86·9	17 29 37	8 53 30	90·2	14·75	86·3	V.G G.	·63850	8·1152	8·1141	+·0011	8·1146		

1892. Date.	Civil Time, Mean.	Magnet N. 23 *a*. Time of one Vibration.	Effect of 90° Torsion.	Temperature.	Rate of Chronometer.	Corresponding Mean Reading of L. H. F. Magnetometer. Scale Reading.	Thermometer.	Angle of Deflection of Magnet N. 23 *c* by N. 23 *a* at Distance. 0·8 foot.	1·0 foot.	Temperature.	Corresponding Mean Reading of L. H. F. Magnetometer. Scale Reading.	Thermometer.	Observer.	Calculated Results in English Units. Values of m.	Values of X. From Deflections at distance. 0·8 foot ($X_{0\cdot8}$)	1·0 foot ($X_{1\cdot0}$)	Difference. $X_{0\cdot8}-X_{1\cdot0}$	Mean. $\frac{X_{0\cdot8}+X_{1\cdot0}}{2}$	Monthly Mean Values of X.	Monthly Mean Values of X in Metrical Units.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
	h. m.	s.	Sc. div.	°	s.		°	° ′ ″	° ′ ″	°		°								
April 6	12 19	2·8394	0·42	91·9	+7·5	15·50	87·8	17 27 46	8 52 31	91·8	15·17	88·2	G.S.J.	·63822	8·1253	8·1249	+·0004	8·1251		
,, ,,	15 25	2·8412	0·44	92·8	+7·5	14·68	88·5	17 27 56	8 52 35	93·1	14·83	88·3	G.S.J.	·63822	8·1193	8·1188	+·0005	8·1190		
,, 13	12 21	2·8399	0·39	91·1	+7·8	15·36	87·5	17 28 3	8 52 40	91·3	15·13	87·8	G.S.J.	·63816	8·1229	8·1223	+·0006	8·1226		
,, ,,	15 23	2·8415	0·43	91·0	+7·8	14·46	88·8	17 28 26	8 52 54	92·3	14·58	88·3	G.S.J.	·63810	8·1158	8·1148	+·0010	8·1153		
,, 20	12 11	2·8396	0·39	92·0	+8·6	15·34	88·7	17 27 32	8 52 31	91·9	15·12	88·9	G.S.J.	·63820	8·1259	8·1246	+·0013	8·1252	8·1188	3·7434
,, ,,	15 21	2·8408	0·36	90·8	+8·6	14·46	89·9	17 27 48	8 52 40	93·0	14·71	89·5	G.S.J.	·63822	8·1195	8·1180	+·0015	8·1187		
,, 27	12 11	2·8417	0·40	93·4	+8·6	13·90	89·4	17 28 20	8 53 00	94·1	14·02	89·9	D.	·63844	8·1160	8·1139	+·0021	8·1149		
,, ,,	15 56	2·8421	0·40	93·4	+8·6	13·30	90·9	17 29 5	8 53 27	95·0	13·38	90·6	D.	·63859	8·1113	8·1087	+·0026	8·1100		
May 4	12 13	2·8415	0·41	93·3	+9·3	14·40	88·8	17 29 8	8 53 25	94·0	13·75	89·8	G.S.J.	·63840	8·1137	8·1115	+·0022	8·1126		
,, ,,	15 30	2·8428	0·40	92·6	+9·3	13·48	91·2	17 29 2	8 53 20	94·3	13·55	91·0	G.S.J.	·63829	8·1094	8·1076	+·0018	8·1085		
,, 11	12 28	2·8411	0·44	93·1	+9·1	14·76	88·8	17 28 15	8 52 52	93·5	14·57	89·0	D.	·63828	8·1107	8·1094	+·0013	8·1100		
,, ,,	15 53	2·8419	0·50	91·9	+9·1	13·93	89·9	17 28 17	8 52 56	94·2	14·27	89·6	D.	·63832	8·1141	8·1124	+·0017	8·1132		
,, 18	11 57	2·8404	0·45	90·9	+8·5	15·22	88·0	17 27 50	8 52 46	91·0	15·26	88·5	G.S.J.	·63815	8·1223	8·1201	+·0022	8·1212	8·1111	3·7399
,, ,,	15 38	2·8468	0·39	90·4	+8·5	12·03	89·7	17 31 50	8 54 50	90·9	13·00	89·2	G..S J.	·63826	8·0887	8·0861	+·0026	8·0874		
,, 25	12 25	2·8410	0·44	93·5	+8·5	14·92	90·0	17 27 11	8 52 20	94·3	14·75	90·2	D.	·63809	8·1223	8·1210	+·0013	8·1216		
,, ,,	16 1	2·8425	0·45	93·6	+8·5	13·88	91·0	17 27 45	8 52 40	95·1	14·22	90·8	D.	·63823	8·1152	8·1135	+·0017	8·1143		
June 1	12 13	2·8418	0·42	90·0	+8·4	14·51	87·5	17 28 56	8 53 10	90·8	14·46	87·9	G.S.J.	·63801	8·1137	8·1126	+·0011	8·1131		
,, ,,	15 23	2·8425	0·38	89·4	+8·4	14·01	88·4	17 29 10	8 53 15	90·6	14·25	88·5	G.S.J.	·63797	8·1105	8·1098	+·0007	8·1101		
,, 8	12 17	2·8415	0·44	83·2	+7·8	16·01	83·2	17 29 0	8 53 7	84·3	15·90	83·2	V.G.G.	·63706	8·1143	8·1137	+·0006	8·1140		
,, ,,	15 13	2·8429	0·42	84·2	+7·8	15·07	83·3	17 29 40	8 53 25	84·6	15·43	83·4	V.G.G.	·63728	8·1085	8·1083	+·0002	8·1084		
,, 15	12 11	2·8416	0·42	89·5	+7·6	16·00	85·4	17 27 15	8 52 15	90·1	15·79	86·1	V.G.G.	·63738	8·1206	8·1203	+·0003	8·1204		
,, ,,	15 21	2·8416	0·39	91·2	+7·6	15·30	86·8	17 27 25	8 52 20	90·8	15·23	86·5	V·G·G.	·63759	8·1208	8·1204	+·0004	8·1206	8·1142	3·7413
,, 22	12 13	2·8417	0·37	90·4	+6·8	15·43	85·7	17 26 50	8 52 5	90·7	15·39	86·6	V.G.G.	·63744	8·1221	8·1214	+·0007	8 1277		
,, ,,	15 15	2·8420	0·40	90·0	+6·8	14·65	86·4	17 27 27	8 52 25	91·9	15·03	86·3	V.G.G.	·63778	8·1176	8·1167	+·0009	8·1171		
,, 29	12 15	2·8425	0·35	90·6	+7·3	14·39	87·1	17 29 9	8 53 19	90·8	14·14	87·3	G.S.J.	·63784	8·1113	8·1100	+·0013	8·1106		
,, ,,	15 19	2·8440	0·37	91·1	+7·3	13·56	88·0	17 29 2	8 53 15	92·1	13·94	87·8	G.S.J.	·63788	8·1068	8·1055	+·0013	8·1061		
July 6	12 20	2·8418	0·38	91·8	+7·1	15·52	87·4	17 26 37	8 52 5	91·7	15·36	87·9	V.G.G.	·63747	8·1231	8·1214	+·0017	8·1222		
,, ,,	15 18	2·8428	0·38	91·5	+7·1	14·30	88·9	17 27 0	8 52 15	93·0	14·86	88·7	V.G.G.	·63773	8·1171	8·1158	+·0013	8·1164		
,, 13	12 17	2·8437	0·38	85·4	+7·2	13·62	83·4	17 32 50	8 55 10	85·4	13·38	83·7	V.G.G.	·63795	8·0947	8·0932	+·0015	8·0939		
,, ,,	15 21	2·8453	0·37	84·8	+7·2	12·83	84·0	17 32 32	8 55 0	85·7	13·40	83·9	V.G.G.	·63784	8·0904	8·0889	+·0015	8·0896		
,, 20	12 12	2·8414	0·33	86·5	+6·8	14·82	83·8	17 29 37	8 53 30	86·7	14·78	84·0	V.G.G.	·63775	8·1130	8·1120	+·0010	8·1125	8·1083	3·7386
,, ,,	15 16	2·8418	0·37	86·7	+6·8	14·44	84·7	17 30 10	8 53 45	86·9	14·58	84·4	V.G.G.	·63790	8·1098	8·1089	+·0009	8·1093		
,, 27	12 8	2·8406	0·32	85·2	+6·4	14·80	83·8	17 29 36	8 53 32	86·6	14·91	84·0	G.S.J.	·63793	8·1143	8·1130	+·0013	8·1136		
,, ,,	15 20	2·8409	0·33	83·6	+6·4	14·48	83·7	17 30 27	8 53 55	85·7	14·63	84·1	G.S.J.	·63794	8·1096	8·1087	+·0009	8·1091		

August 3	12 15	2·8388	0·34	84·6	+6·0	15·86	82·8	17 29 20	8 53 22	84·2	15·80	82·9	V.G.G.	·63793	8·1221	8·1210	+·0011	8·1215		
,, ,,	15 15	2·8399	0·32	83·2	+6.0	14·89	82·9	17 30 0	8 53 40	85·0	15·21	83·0	V.G.G.	·63801	8·1147	8·1137	+·0010	8·1142		
,, 10	12 20	2·8389	0·30	85·2	+6·2	15·73	82·7	17 29 53	8 53 38	83·2	15·56	82·7	G.S.J.	·63797	8·1212	8·1203	+·0009	8·1207		
,, ,,	15 24	2·8395	0·28	83·0	+6·2	15·01	82·4	17 30 5	8 53 45	83·6	15·34	82·5	G.S.J.	·63804	8·1165	8·1154	+·0011	8·1159		
,, 17	12 11	2·8388	0·32	83·8	+6·4	15·69	81·1	17 29 50	8 53 39	83·7	15·57	81·7	V.G.G.	·63800	8·1203	8·1188	+·0015	8·1195	8·1167	3·7424
,, ,,	15 16	2·8395	0·31	81·1	+6·4	14·97	81·6	17 29 55	8 53 42	84·7	15·17	81·7	V.G.G.	·63788	8·1145	8·1132	+·0013	8·1138		
,, 24	12 11	2·8401	0·29	87·9	+6·3	15·31	83·4	17 28 31	8 52 57	87·9	15·26	83·7	G.S.J.	·63791	8·1208	8·1199	+·0009	8·1203		
,, ,,	15 23	2·8427	0·29	87·0	+6·3	13·95	84·3	17 29 53	8 53 41	88·1	14·46	84·1	G.S.J.	·63793	8·1076	8·1062	+·0014	8·1069		
,, 31	12 20	2·8378	0·29	79·7	+5·5	16·07	79·2	17 30 35	8 54 4	79·0	15·93	79·1	V.G.G.	·63778	8·1208	8·1193	+·0015	8·1200		
,, ,,	15 17	2·8391	0·30	79·0	+5·5	15·42	79·0	17 30 57	8 54 17	79·0	15·72	79·0	V.G.G.	·63778	8·1152	8·1133	+·0019	8·1142		
September 7	12 44	2·8399	0·27	85·0	+7·0	15·25	82·0	17 30 4	8 53 46	84·9	14·95	82·2	G.S.J.	·63788	8·1161	8·1148	+·0013	8·1154		
,, ,,	15 13	2·8406	0·28	84·8	+7·0	14·85	82·7	17 30 23	8 53 53	85·1	14·76	82·5	G.S.J.	·63788	8·1124	8·1115	+·0009	8·1119		
,, 14	12 13	2·8389	0·30	84·9	+7·0	15·79	81·0	17 28 52	8 53 9	85·0	15·71	81·4	V.G.G.	·63787	8·1231	8·1219	+·0012	8·1225		
,, ,,	15 15	2·8393	0·29	83·0	+7·0	15·26	82·2	17 28 37	8 53 1	85·9	15·69	82·1	V.G.G.	·63785	8·1204	8·1193	+·0011	8·1198	8·1209	3·7444
,, 21	12 20	2·8375	0·29	86·0	+5·1	16·40	82·1	17 27 22	8 52 20	85·9	16·36	82·7	D.	·63787	8·1326	8·1322	+·0004	8·1324		
,, ,,	15 31	2·8384	0·30	85·3	+5·1	15·17	83·0	17 28 5	8 52 41	86·3	15·81	83·0	D.	·63816	8·1266	8·1259	+·0007	8·1262		
,, 28	12 9	2·8381	0·30	87·3	+5·6	15·65	82·9	17 28 52	8 53 7	86·1	15·31	83·2	V.G.G.	·63813	8·1262	8·1253	+·0009	8·1257		
,, ,,	15 18	2·8402	0·31	85·6	+5·6	14·33	83·9	17 29 59	8 53 42	86·7	14·56	83·8	V.G.G.	·63819	8·1141	8·1130	+·0011	8·1135		
October 5	12 34	2·8378	0·43	87·4	+5·4	15·55	84·8	17 28 7	8 52 42	87·1	15·31	85·0	D.	·63807	8·1289	8·1283	+·0006	8·1286		
,, ,,	15 44	2·8402	0·48	86·9	+5·4	14·14	85·6	17 29 30	8 53 22	87·7	14·36	85·4	D.	·63813	8·1158	8·1154	+·0004	8·1156		
,, 12	12 10	2·8389	0·49	90·7	+6·1	15·18	86·0	17 27 57	8 52 37	89·7	14·75	86·4	V.G.G.	·63809	8·1268	8·1262	+·0006	8·1265		
,, ,,	15 17	2·8433	0·47	88·4	+6·1	12·73	87·7	17 28 50	8 53 5	90·5	13·82	87·2	V.G.G.	·63797	8·1085	8·1076	+·0009	8·1080	8·1190	3·7435
,, 18	12 16	2·8392	0·48	88·6	+8·1	14·71	86·2	17 28 42	8 53 2	88·3	14·55	86·7	D.	·63818	8·1229	8·1219	+·0010	8·1224		
,, ,,	15 32	2·8436	0·55	87·0	+8·1	12·57	87·0	17 29 40	8 53 30	88·6	13·94	87·0	D.	·63809	8·1049	8·1042	+·0007	8·1045		
,, 26	12 16	2·8388	0·56	88·1	+5·3	15·65	83·9	17 27 52	8 52 40	87·2	15·42	84·1	V.G.G.	·63784	8·1274	8·1261	+·0013	8·1267		
,, ,,	15 21	2·8399	0·55	86·8	+5·3	14·74	84·4	17 28 25	8 52 55	88·2	14·93	84·4	V.G.G.	·63791	8·1201	8·1191	+·0010	8·1196		
November 2	12 12	2·8380	0·60	87·6	+6·7	15·74	84·6	17 27 40	8 52 30	86·6	15·39	84·7	D.	·63779	8·1306	8·1298	+·0008	8·1302		
,, ,,	15 25	2·8398	0·66	85·9	+6·7	14·72	84·3	17 28 47	8 53 7	87·0	14·84	84·6	D.	·63790	8·1193	8·1180	+·0013	8·1186		
,, 9	12 17	2·8382	0·60	88·1	+9·6	15·40	84·1	17 28 17	8 52 52	86·7	15·25	84·5	V.G.G.	·63813	8·1283	8·1272	+·0011	8·1277		
,, ,,	15 14	2·8391	0·62	86·2	+9·6	14·64	85·3	17 28 32	8 53 2	87·9	14·90	85·0	V.G.G.	·63812	8·1219	8·1204	+·0015	8·1211		
,, 16	12 20	2·8375	0·64	86·5	+10·7	15·80	82·3	17 28 47	8 53 12	85·6	15·51	83·0	D.	·63823	8·1281	8·1262	+·0019	8·1271	8·1240	3·7458
,, ,,	15 29	2·8387	0·63	84·9	+10·7	15·19	84·0	17 29 10	8 53 22	86·7	15·24	83·4	D.	·63812	8·1208	8·1191	+·0017	8·1199		
,, 23	12 7	2·8378	0·57	85·7	+10·0	16·25	81·9	17 28 45	8 53 10	85·1	16·05	82·0	V.G.G.	·63806	8·1272	8·1255	+·0017	8·1263		
,, ,,	15 17	2·8386	0·61	84·7	+10·0	15·28	83·5	17 29 3	8 53 17	86·1	15·65	82·9	V.G.G.	·63820	8·1219	8·1204	+·0015	8·1211		
,, 30	12 11	2·8384	0·65	84·8	+9·3	16·17	81·0	17 28 30	8 52 57	84·4	16·18	81·5	D.	·63784	8·1261	8·1251	+·0010	8·1256		
,, ,,	15 26	2·8387	0·69	84·9	+9·3	15·70	82·9	17 28 35	8 53 00	86·0	15·98	81·9	D.	·63793	8·1234	8·1223	+·0011	8·1228		
December 7	12 20	2·8392	0·62	84·8	+10·3	15·41	80·6	17 29 49	8 53 35	85·2	15·27	80·9	V G.G.	·63801	8·1182	8·1173	+·0009	8·1177		
,, ,,	15 13	2·8395	0·63	85·2	+10·3	14·87	82·9	17 30 2	8 53 40	86·5	15·03	82·3	V.G.G.	·63822	8·1158	8·1150	+·0008	8·1154		
,, 14	12 24	2·8391	0·58	85·2	+9·2	15·78	80·2	17 28 45	8 53 00	85·2	15·78	80·7	D.	·63781	8·1229	8·1223	+·0006	8·1226		
,, ,,	15 44	2·8394	0·60	84·7	+9·2	15·09	82·3	17 29 7	8 53 12	86·0	15·36	81·7	D.	·63793	8·1193	8·1188	+·0005	8·1190		
,, 21	12 10	2·8385	0·62	86·3	+7·8	15·86	82·1	17 27 32	8 52 29	86·1	15·80	82·5	V.G.G.	·63771	8·1291	8·1279	+·0012	8·1285	8·1216	3·7447
,, ,,	15 20	2·8396	0·63	85·8	+7·8	14·88	83·9	17 27 47	8 52 37	87·6	15·35	83·2	V.G.G.	·63778	8·1231	8·1218	+·0013	8·1224		
,, 28	12 13	2·8384	0·63	84·5	+10·3	15·97	80·0	17 28 32	8 53 2	84·1	16·01	80·3	V.G.G.	·63784	8·1262	8·1246	+·0016	8·1254		
,, ,,	15 13	2·8387	0·62	84·6	+10·3	15·58	81·9	17 28 50	8 53 12	85·6	15·74	81·4	V.G.G.	·63797	8·1229	8·1212	+·0017	8·1220		

The mean value of the Horizontal Force for the year 1892=8·1166 | 3·7424

Absolute Magnetical Observations.—Table V.

Observations of Absolute Declination.

1892.

1892. Date.	Bombay Civil Time.	Mean Readings. Collimator Magnet. Scale apparently Erect.	Collimator Magnet. Scale apparently Inverted.	Horizontal Circle with Telescope pointed to Scale of Collimator Magnet.	Horizontal Circle with Telescope pointed to Tárdeo Chimney.	Torsion. Mean.	Torsion. Effect of 90°.	Observer.	Corresponding Reading of large Declination Magnetometer.	Absolute Easterly Declination corrected for Torsion.	Monthly Mean. Corresponding Reading of large Declination Magnetometer.	Monthly Mean. Absolute Easterly Declination.
1	2	3	4	5	6	7	8	9	10	11	12	13
	h. m.	Sc. div.	Sc. div.	° ′ ″	° ′ ″	°	Sc. div.		Sc. div.	° ′ ″	Sc. div.	° ′ ″
JAN. 7	11 38	+1·51	+1·61	17 10 30	196 52 0	0		V. G. G.	35·23	0 44 49	35·07	0 43 40
,, 15	11 21	+1·52	+1·62	17 9 40	196 52 20	0		G. S. J.	35·07	0 43 39		
,, 22	11 40	+1·47	+1·72	17 6 45	196 52 0	0		V. G. G.	34·67	0 40 54		
,, 28	11 19	+1·52	+1·61	17 10 35	196 51 37	0		G. S. J..	35·33	0 45 18		
FEB. 4	11 29	+1·52	+1·61	17 9 15	196 51 40	0		V. G. G.	35·11	0 43 55	35·18	0 44 19
,, 11	11 10	+1·61	+1·39	17 9 15	196 51 30	10W	0·86	G. S. J.	35·23	0 44 39		
,, 18	11 31	+1·57	+1·55	17 10 5	196 51 40	0		V. G. G.	35·27	0 44 52		
,, 25	11 28	+1·56	+1·56	17 8 55	196 51 32	0		G. S. J.	35·13	0 43 49		
MAR. 3	11 25	+1·59	+1·49	17 11 30	196 51 40	0		V. G. G.	35·50	0 46 23	35·16	0 44 11
,, 10	11 24	+1·51	+1·67	17 10 40	196 51 55	0		G. S. J.	35·27	0 45 0		
,, 17	11 28	+1·49	+1·70	17 11 40	196 52 30	0		V. G. G.	35·31	0 45 22		
,, 24	11 18	+1·44	+1·81	17 7 0	196 51 10	0		G. S. J.	34·82	0 41 51		
,, 31	11 28	+1·49	+1·72	17 7 10	196 51 0	0		V. G. G.	34·91	0 42 21		
APR. 7	11 25	+1·47	+1·67	17 7 15	196 51 7	0		G. S. J.	34·89	0 42 20	34·88	0 42 15
,, 14	11 29	+1·47	+1·67	17 7 40	196 52 5	0		D.	34·82	0 41 47		
,, 21	11 23	+1·50	+1·67	17 7 50	196 51 7	0		G. S. J.	34·99	0 42 58		
,, 28	11 23	+1·46	+1·77	17 7 10	196 51 20	0		D.	34·82	0 41 55		
MAY 5	11 26	+1·49	+1·66	17 6 35	196 50 50	0		G. S. J.	34·86	0 42 0	34·89	0 42 15
,, 12	11 38	+1·52	+1·65	17 7 50	196 52 10	0		D.	34·85	0 41 58		
,, 19	11 31	+1·47	+1·66	17 7 30	196 51 25	0		G. S. J.	34·91	0 42 19		
,, 26	11 28	+1·51	+1·65	17 7 42	196 51 15	0		D.	34·96	0 42 43		
JUNE 2	11 29	+1·52	+1·64	17 5 50	196 51 0	0		G. S. J.	34·71	0 41 8	34·77	0 41 31
,, 9	11 30	+1·49	+1·79	17 5 45	196 51 40	0		V. G. G.	34·56	0 40 10		
,, 16	11 36	+1·51	+1·61	17 7 5	196 51 50	0		V. G. G.	34·78	0 41 34		
,, 23	11 30	+1·51	+1·65	17 7 30	196 51 40	0		V. G. G.	34·85	0 42 6		
,, 30	11 24	+1·47	+1·67	17 7 55	196 51 30	0		G. S. J.	34·94	0 42 37		
JULY 7	11 34	+1·51	+1·67	17 5 35	196 51 30	0		V. G. G.	34·61	0 40 20	34·84	0 41 52
,, 14	11 36	+1·56	+1·52	17 5 40	196 51 40	0		V. G. G.	34·65	0 40 29		
,, 21	11 29	+1·52	+1·61	17 8 40	196 51 20	0		V. G. G.	35·12	0 43 40		
,, 28	11 35	+1·47	+1·71	17 8 0	196 51 25	10W	0·78	G. S. J.	34·99	0 42 59		
AUG. 4	11 43	+1·46	+1·80	17 7 0	196 51 7	5W	0·57	V. G. G	34·82	0 42 0	34·70	0 41 16
,, 11	11 25	+1·57	+1·52	17 6 25	196 50 50	0		G. S. J.	34·83	0 42 4		
,, 18	11 34	+1·49	+1·67	17 6 40	196 51 20	0		V. G. G.	34·75	0 41 39		
,, 25	11 28	+1·54	+1·60	17 3 25	196 50 25	0		G. S. J.	34·39	0 39 22		
SEPT. 1	11 35	+1·50	+1·69	17 5 40	196 51 15	10W	0·61	V. G. G.	34·60	0 40 48	34·69	0 41 29
,, 8	11 35	+1·49	+1·70	17 5 20	196 50 20	0		D.	34·66	0 41 12		
,, 15	11 28	+1·52	+1·65	17 6 10	196 51 0	0		V. G. G.	34·69	0 41 28		
,, 22	11 26	+1·51	+1·75	17 4 50	196 50 25	0	--	D.	34·54	0 40 34		
,, 29	11 37	+1·46	+1·72	17 7 15	196 50 0	0		V. G. G.	34·95	0 43 23		
OCT. 6	11 35	+1·52	+1·67	17 5 40	196 49 45	0		D.	34·78	0 42 11	34·76	0 42 8
,, 13	11 39	+1·57	+1·55	17 5 0	196 50 0	0		V. G. G.	34·66	0 41 27		
,, 20	11 21	+1·51	+1·55	17 5 20	169 49 45	0		D.	34·74	0 41 58		
,, 27	11 31	+1·57	+1·49	17 6 15	196 49 50	0		V. G. G.	34·88	0 42 57		
NOV. 3	11 4[illegible]	+1·56	+1·64	17 7 30	196 49 50	0		D.	35·02	0 44 0	34·91	0 43 16
,, 10	11 2[illegible]	+1·52	+1·50	17 6 30	196 50 0	10W	0·59	V. G. G.	34·87	0 43 6		
,, 17	11 2[illegible]	+1·59	+1·62	17 7 10	196 49 37	0		D.	35·01	0 43 58		
,, 24	11 32	+1·52	+1·56	17 5 35	196 49 57	0		V. G. G.	34·74	0 42 1		
DEC. 1	11 17	+1·51	+1·61	17 7 40	196 50 20	0		D.	35·00	0 43 39	35·05	0 43 46
,, 8	11 28	+1·59	+1·47	17 10 0	196 50 50	0		V. G. G.	35·33	0 45 44		
,, 15	11 34	+1·61	+1·46	17 7 20	196 50 25	10W	0·68	D.	35·04	0 43 41		
,, 22	11 31	+1·52	+1·61	17 7 40	196 50 17	0		V. G. G.	35·05	0 43 43		
,, 29	11 23	+1·51	+1·64	17 6 5	196 50 20	0		V. G. G.	34·81	0 42 3		

The Mean Declination for the year 1892 = 0 42 40

Absolute Magnetical Observations.—Table VI.

OBSERVATIONS OF INCLINATION, 1892.

Taken with Barrow's Dip Circle, with Microscopes, No. 49 and two 3½-inch Needles, Nos. 1 and 2, by Dover, Charlton.

1892. Date.	Bombay Civil Time (0 to 24 hours). At commencement.	At conclusion.	Observer.	Needle marked.	End of Needle Dipping. A. Face of Circle. East.	A. Face of Circle. West.	B. Face of Circle. East.	B. Face of Circle. West.	Mean Dip.	Monthly Mean for each Needle.	Monthly Mean.
	h. m.	h. m.			° ′	° ′	° ′	° ′	° ′		° ′
JAN. 1	14 48	16 10	G.S.J.	1	20 57·0	20 59·7	20 4·5	20 7·4	20 32·1		
„ 5	12 8	13 29	G.S.J.	1	20 57·2	21 2·5	20 6·1	20 6·9	20 33·2	No. 1	
„ 8	14 43	16 4	V.G.G.	2	20 42·0	20 55·4	20 6·7	20 18·1	20 30·5	° ′	
„ 12	12 14	13 37	G.S.J.	2	20 58·1	20 42·6	20 17·0	20 13·7	20 32·8	20 32·9	
„ 15	14 40	16 1	G.S.J.	1	20 55·2	21 1·9	20 3·9	20 10·6	20 32·9		20 32·5
„ 19	12 12	13 38	V.G.G.	1	20 47·5	21 5·2	20 8·0	20 9·0	20 32·4	No. 2	
„ 22	14 36	15 54	V.G.G.	2	20 42·1	20 57·4	20 12·0	20 16·7	20 32·0	° ′	
„ 26	12 8	13 30	G.S.J.	2	20 55·1	20 49·9	20 17·4	20 7·7	20 32·5	20 31·9	
„ 29	15 7	16 27	G.S.J.	1	20 55·5	21 1·7	20 4·2	20 14·1	20 33·9		
FEB. 2	12 15	13 40	V.G.G.	1	20 56·5	21 0·7	20 6·4	20 10·1	20 33·4		
„ 5	14 43	16 7	V.G.G.	2	20 47·6	20 56·9	20 10·4	20 14·7	20 32·4	No. 1	
„ 9	12 16	13 41	G.S.J.	2	20 48·2	20 51·1	20 16·3	20 17·4	20 33·2	° ′	
„ 12	14 45	16 5	G.S.J.	1	20 52·9	21 1·7	20 4·1	20 7·2	20 31·5	20 32·5	20 32·3
„ 16	12 15	13 40	V.G.G.	1	20 55·2	20 59·9	19 58·0	20 10·4	20 30·9		
„ 19	14 45	16 8	V.G.G.	2	20 48·4	20 53·1	20 13·6	20 15·4	20 32·6	No. 2	
„ 23	12 3	13 28	G.S.J.	2	20 46·6	20 46·9	20 15·4	20 12·4	20 30·3	° ′	
„ 27	14 42	16 5	G.S.J.	1	20 59·4	21 4·3	20 1·0	20 11·7	20 34·1	20 32·1	
MARCH 1	12 12	13 38	V.G.G.	1	20 56·5	21 4·1	19 56·7	20 14·1	20 32·8		
„ 4	14 43	16 6	V.G.G.	2	20 49·1	20 48·2	20 10·6	20 13·1	20 30·2	No. 1	
„ 8	12 10	13 32	G.S.J.	2	20 51·4	20 49·9	20 15·1	20 13·2	20 32·4	° ′	
„ 11	14 54	16 11	G.S.J.	1	21 0·0	21 3·1	20 4·8	20 9·6	20 34·4	20 34·0	20 32·9
„ 15	12 10	13 38	V.G.G.	1	20 59·1	21 2·1	20 1·1	20 10·5	20 33·2		
„ 18	14 45	15 59	V.G.G.	2	20 47·9	20 52·6	20 13·2	20 15·6	20 32·3	No. 2	
„ 22	12 15	13 40	V.G.G.	2	20 49·6	20 51·1	20 9·7	20 17·0	20 31·8	° ′	
„ 25	14 55	16 13	G.S.J.	1	21 4·1	21 2·4	20 6·0	20 7·1	20 34·9	20 31·7	
„ 29	12 20	13 43	V.G.G.	1	20 59·6	21 3·0	20 5·2	20 10·4	20 34·5		
APRIL 1	14 40	16 5	V.G.G.	2	20 50·9	20 52·2	20 14·0	20 11·7	20 32·2		
„ 4	12 17	13 39	G.S.J.	2	20 56·1	20 50·2	20 17·6	20 12·9	20 34·2	No. 1	
„ 8	15 8	16 32	G.S.J.	1	21 7·4	21 5·4	20 5·5	20 4·5	20 35·7	° ′	
„ 12	12 10	13 33	V.G.G.	1	21 2·2	21 3·5	20 7·6	20 8·0	20 35·3	20 35·1	
„ 15	14 59	16 24	D.	2	20 50·5	20 50·1	20 20·2	20 18·1	20 34·7		20 34·6
„ 19	12 20	13 41	V.G.G.	2	20 52·5	20 50·4	20 19·7	20 16·1	20 34·7	No. 2	
„ 22	14 50	16 8	G.S.J.	1	21 0·7	21 0·1	20 8·2	20 9·7	20 34·7	° ′	
„ 26	12 15	13 38	V.G.G.	1	20 57·1	21 0·9	20 9·2	20 12·1	20 34·8	20 34·1	
„ 29	15 10	16 33	D.	2	20 53·0	20 54·2	20 10·0	20 22·0	20 34·8		
MAY 2	12 3	13 25	G.S.J.	2	20 50·4	20 51·2	20 20·2	20 14·2	20 34·0		
„ 6	14 48	16 10	G.S.J.	1	21 1·9	21 4·5	20 7·1	20 9·9	20 35·8	No. 1	
„ 10	12 15	13 39	D.	1	20 54·7	21 5·6	20 5·4	20 6·4	20 33·0	° ′	
„ 13	15 30	17 1	D.	2	20 49·7	20 49·4	20 16·2	20 16·1	20 32·8	20 34·1	
„ 17	12 30	13 53	G.S.J.	2	20 52·4	20 51·8	20 19·5	20 15·4	20 34·8		20 33·9
„ 20	14 42	16 4	G.S.J.	1	20 56·6	21 1·4	20 8·7	20 9·4	20 34·0	No. 2	
„ 23	12 25	13 53	D.	1	20 48·2	21 5·9	20 8·0	20 12·1	20 33·5	° ′	
„ 27	14 35	16 5	V.G.G.	2	20 49·9	20 57·7	20 8·9	20 14·1	20 32·6	20 33·8	
„ 31	12 12	13 34	G.S.J.	2	20 50·1	20 53·0	20 16·9	20 19·0	20 34·7		

1892. Date.	Bombay Civil Time (0 to 24 hours). At commencement.		At conclusion.		Observer.	Needle marked.	End of Needle Dipping. A. Face of Circle. East.		End of Needle Dipping. A. Face of Circle. West.		End of Needle Dipping. B. Face of Circle. East.		End of Needle Dipping. B. Face of Circle. West.		Mean Dip.	Monthly Mean for each Needle.	Monthly Mean.
	h.	m.	h.	m.			°	′	°	′	°	′	°	′	°	′	° ′
JUNE 3	14	54	16	16	G.S.J.	1	21	3·9	21	6·5	20	3·2	20	10·0	20	35·9	No. 1 ° ′
„ 7	12	15	13	37	V.G.G.	1	20	59·4	21	7·5	20	4·4	20	10·6	20	35·5	
„ 10	14	40	16	6	V.G.G.	2	20	52·6	20	55·2	20	10·4	20	21·5	20	34·9	20 35·5
„ 14	12	23	13	45	V.G.G.	2	20	51·6	20	57·0	20	7·5	20	20·1	20	34·0	
„ 17	14	38	16	4	V.G.G.	1	20	59·9	21	3·6	20	5·4	20	11·4	20	35·1	20 34·7
„ 21	12	15	13	40	V.G.G.	1	20	56·4	21	4·6	20	9·2	20	12·1	20	35·6	No. 2 ° ′
„ 24	14	42	16	6	V.G.G.	2	20	47·4	20	55·7	20	14·2	20	23·2	20	35·1	
„ 28	12	14	13	39	G.S.J.	2	20	48·1	20	48·7	20	14·1	20	15·4	20	31·6	20 33·9
JULY 1	14	46	16	8	G.S.J.	1	20	56·9	21	1·1	20	9·9	20	15·4	20	35·8	No. 1 ° ′
„ 5	12	23	13	45	V.G.G.	1	20	57·5	21	0·9	20	8·9	20	14·9	20	35·5	
„ 8	14	49	16	9	V.G.G.	2	20	46·4	20	49·9	20	14·5	20	19·9	20	32·7	20 35·7
„ 12	12	15	13	45	V.G.G.	2	20	47·7	20	53·9	20	6·4	20	19·4	20	31·8	
„ 15	14	48	16	10	V.G.G.	1	20	56·6	21	3·2	20	5·5	20	15·6	20	35·2	
„ 19	12	20	13	44	V.G.G.	1	20	58·1	21	6·5	20	4·6	20	12·7	20	35·5	20 34·4
„ 22	14	48	16	10	V.G.G.	2	20	51·9	20	59·0	20	4·7	20	17·7	20	33·3	No. 2 ° ′
„ 26	12	26	13	46	G.S.J.	2	20	46·7	20	56·4	20	9·5	20	20·1	20	33·2	
„ 29	14	45	16	6	G.S.J.	1	20	52·5	21	11·0	20	4·2	20	19·1	20	36·7	20 32·7
AUGUST 2	12	15	13	40	V.G.G.	1	20	54·9	21	7·9	20	7·1	20	16·7	20	36·6	No. 1 ° ′
„ 5	14	50	16	20	V.G.G.	2	20	42·0	20	56·5	20	10·6	20	20·5	20	32·4	
„ 9	12	20	13	44	G.S.J.	2	20	53·0	20	55·2	20	13·4	20	16·5	20	34·5	20 34·9
„ 12	14	37	15	58	G.S.J.	1	20	56·2	21	6·0	20	5·7	20	13·6	20	35·4	
„ 16	12	13	13	40	V.G.G.	1	20	51·0	21	8·6	20	5·9	20	15·7	20	35·3	20 34·3
„ 19	14	44	16	5	V.G.G.	2	20	44·6	20	56·7	20	11·1	20	24·4	20	34·2	
„ 23	12	25	13	45	G.S.J.	2	20	48·4	20	50·4	20	17·4	20	15·5	20	32·9	No. 2 °
„ 27	14	41	16	4	G.S.J.	1	20	59·5	21	3·4	20	7·1	20	6·1	20	34·0	
„ 30	12	10	13	35	V.G.G.	1	20	55·4	21	3·7	20	4·9	20	8·5	20	33·1	20 33·5
SEPT. 2	14	40	16	5	V.G.G.	2	20	44·6	20	53·0	20	14·9	20	12·4	20	31·2	No. 1 ° ′
„ 6	12	22	13	47	D.	2	20	41·6	20	55·7	20	10·6	20	21·4	20	32·3	
„ 9	15	10	16	39	D.	1	20	40·7	21	4·1	19	58·0	20	21·6	20	31·1	20 31·0
„ 13	12	20	13	48	V.G.G.	1	20	36·9	21	2·2	19	57·4	20	26·5	20	30·7	
„ 16	14	48	16	15	V.G.G.	2	20	40·6	20	51·4	20	2·7	20	25·5	20	30·0	20 30·4
„ 20	12	48	14	19	D.	2	20	27·6	21	8·0	19	50·5	20	29·1	20	28·8	
„ 23	15	8	16	41	D.	1	20	44·1	21	7·5	19	53·7	20	19·2	20	31·1	No. 2 ° ′
„ 27	12	19	13	45	V.G.G.	1	20	43·4	21	12·5	19	49·7	20	18·7	20	31·1	
„ 30	14	40	16	2	V.G.G.	2	20	33·7	20	53·5	19	49·2	20	31·7	20	27·0	20 29·9
OCT. 4	12	36	14	16	D.	2	20	28·5	21	4·7	20	0·7	20	22·1	20	29·0	No. 1 ° ′
„ 7	15	14	16	45	D.	1	20	43·6	21	14·1	19	51·6	20	8·9	20	29·5	
„ 11	12	10	13	38	V.G.G.	1	20	32·6	21	19·4	19	52·1	20	18·6	20	30·7	20 31·2
„ 14	14	46	16	10	V.G.G.	2	20	29·4	20	59·6	19	52·9	20	29·0	20	27·7	
„ 17	12	52	14	14	D.	2	20	30·4	21	1·9	20	0·2	20	28·1	20	30·1	20 30·1
„ 22	14	58	16	18	D.	1	20	33·6	21	24·2	19	49·0	20	23·9	20	32·7	No. 2 ° ′
„ 25	12	15	13	39	V.G.G.	1	20	36·0	21	19·2	19	47·1	20	26·0	20	32·1	
„ 28	14	45	16	12	V.G.G.	2	20	28·6	21	8·7	19	55·7	20	22·4	20	28·8	20 28·9

1892. Date.	Bombay Civil Time (0 to 24 hours). At commencement.	At conclusion.	Observer.	Needle marked.	End of Needle Dipping. A. Face of Circle. East.	A. Face of Circle. West.	B. Face of Circle. East.	B. Face of Circle. West.	Mean Dip.	Monthly Mean for each Needle.	Monthly Mean.
	h. m.	h. m.			° ′	° ′	° ′	° ′	° ′		° ′
Nov. 1	12 45	14 15	D.	2	20 30·7	21 11·0	19 52·0	20 32·0	20 31·4	No. 1	
„ 4	14 55	16 16	D.	1	20 41·0	21 24·4	19 44·5	20 22·2	20 33·0	° ′	
„ 8	12 25	13 50	V.G.G.	1	20 35·6	21 30·9	19 32·4	20 30·1	20 32·2	20 34·0	
„ 11	14 45	16 14	V.G.G.	2	20 26·5	21 9·7	19 51·7	20 37·2	20 31·3		
„ 15	12 7	13 32	D.	2	20 23·5	21 20·2	19 55·1	20 34·7	20 33·4		20 33·5
„ 18	14 55	16 21	D.	1	20 40·0	21 23·7	19 45·0	20 34·4	20 35·8		
„ 22	12 20	13 45	V.G.G.	1	20 38·1	21 20·6	19 49·1	20 32·9	20 35·2	No. 2	
„ 25	14 41	16 10	V.G.G.	2	20 27·5	21 16·7	19 52·7	20 37·4	20 33·6	° ′	
„ 29	12 16	13 40	D.	2	20 29·0	21 13·6	19 56·9	20 42·0	20 35·4	20 33·0	
Dec. 2	14 28	15 55	D.	1	20 36·2	21 23·2	19 55·0	20 29·4	20 35·9	No. 1	
„ 6	12 22	13 52	V.G.G.	1	20 38·5	21 19·0	19 51·5	20 29·7	20 34·7	° ′	
„ 9	14 41	16 10	V.G.G.	2	20 27·0	21 17·0	19 55·6	20 41·7	20 35·3	20 35·3	
„ 13	12 25	13 52	D.	2	20 29·9	21 16·1	19 58·4	20 45·7	20 37·5		
„ 16	14 45	16 14	D.	1	20 39·2	21 20·7	19 56·2	20 30·9	20 36·7		20 35·9
„ 20	12 28	13 50	V.G.G.	1	20 38·5	21 20·4	19 50·2	20 33·7	20 35·7		
„ 23	14 45	16 7	V.G.G.	2	20 31·7	21 17·9	19 55·2	20 40·4	20 36·3	No. 2	
„ 27	12 28	13 48	V.G.G.	2	20 29·5	21 20·1	19 59·0	20 41·4	20 37·5	° ′	
„ 30	14 53	16 11	G S.J.	1	20 39·1	21 23·2	19 43·2	20 28·7	20 33·5	20 36·6	

		′	′
The Mean Dip for the year ...	With Needle No. 1 =	20	33·8
	With Needle No. 2 =	20	32·7

	°	′
The Mean Dip for the year 1892 =	20	33·3

Absolute Magnetical Observations.—Table VI *a*.

SUPPLEMENTARY OBSERVATIONS OF INCLINATION, 1892.

Taken with Barrow's Dip Circle, with Microscopes, No. 49 and two 3½-inch Needles, Nos. $\frac{1}{81}$ and $\frac{2}{81}$, by John Dover.

1892. Date.	Bombay Civil Time (0 to 24 hours). At commencement.	At conclusion.	Observer.	Needle marked.	End of Needle Dipping. A. Face of Circle. East.	A. Face of Circle. West.	B. Face of Circle. East.	B. Face of Circle. West.	Mean Dip.	Monthly Mean for each Needle	Monthly Mean.
	h. m.	h. m.			° ′	° ′	° ′	° ′	° ′		° ′
JAN. 1	13 55	17 6	G.S.J.	$\frac{1}{81}$	20 31·7	20 32·1	20 31·7	20 34·7	20 32·5		
,, 5	11 15	14 25	G.S.J.	$\frac{1}{81}$	20 33·1	20 34·1	20 31·2	20 34·9	20 33·3	No. $\frac{1}{81}$	
,, 8	13 50	17 5	V.G.G.	$\frac{2}{81}$	20 34·2	20 33·0	20 10·7	20 25·1	20 25·7	° ′ 20 33·4	
,, 12	11 22	14 30	G.S.J.	$\frac{2}{81}$	20 34·2	20 28·5	20 13·1	20 25·4	20 25·3		
,, 15	13 48	16 58	G.S.J.	$\frac{1}{81}$	20 33·2	20 33·6	20 32·6	20 35·4	20 33·7		20 30·0
,, 19	11 20	14 30	V.G.G.	$\frac{1}{81}$	20 28·9	20 35·0	20 29·5	20 37·6	20 32·7		
,, 22	13 40	16 50	V.G.G.	$\frac{2}{81}$	20 34·5	20 32·5	20 7·6	20 27·5	20 25·5	No. $\frac{2}{81}$	
,, 26	11 17	14 27	G.S.J.	$\frac{2}{81}$	20 36·2	20 29·5	20 17·1	20 23·6	20 26·6	° ′ 20 25·8	
,, 29	14 13	17 26	G.S.J.	$\frac{1}{81}$	20 34·0	20 36·4	20 30·4	20 39·0	20 34·9		
FEB. 2	11 20	14 38	V.G.G.	$\frac{1}{81}$	20 29·6	20 38·7	20 32·2	20 38·5	20 34·7	No. $\frac{1}{81}$	
,, 5	13 50	17 5	V.G.G.	$\frac{2}{81}$	20 34·5	20 34·6	20 13·6	20 25·5	20 27·0	° ′ 20 33·2	
,, 9	11 20	14 36	G.S.J.	$\frac{2}{81}$	20 39·7	20 28·5	20 16·5	20 21·4	20 26·5		
,, 12	13 53	17 11	G.S.J.	$\frac{1}{81}$	20 31·5	20 34·4	20 31·5	20 30·1	20 31·9		
,, 16	11 20	14 35	V.G.G.	$\frac{1}{81}$	20 28·1	20 35·7	20 29·9	20 31·9	20 31·4		20 29.8
,, 19	13 50	17 5	V.G.G.	$\frac{2}{81}$	20 42·1	20 29·4	20 14·0	20 19·5	20 26·2	No. $\frac{2}{81}$	
,, 23	11 8	14 24	G.S.J.	$\frac{2}{81}$	20 35·6	20 28·1	20 21·6	20 20·1	20 26·3	° ′ 20 26·5	
,, 27	13 48	17 4	G.S.J.	$\frac{1}{81}$	20 34·5	20 35·7	20 31·1	20 38·1	20 34·8		
MARCH 1	11 20	14 31	V.G.G.	$\frac{1}{81}$	20 28·1	20 36·9	20 29·5	20 40·9	20 33·8		
,, 4	13 50	17 0	V.G.G.	$\frac{2}{81}$	20 32·1	20 29·4	20 23·2	20 24·0	20 27·2	No. $\frac{1}{81}$	
,, 8	11 14	14 29	G.S.J.	$\frac{2}{81}$	20 27·5	20 26·1	20 32·2	20 23·4	20 27·3	° ′ 20 34·5	
,, 11	13 58	17 10	G.S.J.	$\frac{1}{81}$	20 33·2	20 36·2	20 36·5	20 31·9	20 34·4		
,, 15	11 19	14 32	V.G.G.	$\frac{1}{81}$	20 26·6	20 39·9	20 34·2	20 36·7	20 34·3		20 31·1
,, 18	13 50	16 55	V.G.G.	$\frac{2}{81}$	20 26·6	20 26·6	20 29·5	20 24·5	20 26·8		
,, 22	11 22	14 35	V.G.G.	$\frac{2}{81}$	20 23·7	20 28·1	20 27·2	20 25·9	20 26·2	No. $\frac{2}{81}$	
,, 25	14 3	17 5	G.S.J.	$\frac{1}{81}$	20 36·2	20 36·0	20 34·6	20 34·7	20 35·4	° ′ 20 26·9	
,, 29	11 25	14 35	V.G.G.	$\frac{1}{81}$	20 30·1	20 38·1	20 34·4	20 35·9	20 34·6		
APRIL 1	13 48	17 0	V.G.G.	$\frac{2}{81}$	20 25·6	20 26·9	20 28·0	20 28·1	20 27·1		
,, 4	11 23	14 42	G.S.J.	$\frac{2}{81}$	20 31·5	20 22·0	20 30·1	20 25·6	20 27·3	No. $\frac{1}{81}$	
,, 8	14 15	17 27	G.S.J.	$\frac{1}{81}$	20 34·7	20 33·5	20 36·2	20 34·2	20 34·6	° ′ 20 34·2	
,, 12	11 20	14 25	V.G.G.	$\frac{1}{81}$	20 29·0	20 35·7	20 39·0	20 35·6	20 34·8		
,, 15	14 2	17 19	D.	$\frac{2}{81}$	20 27·5	20 23·5	20 24·2	20 33·7	20 27·2		20 30·4
,, 19	11 29	14 30	V.G.G.	$\frac{2}{81}$	20 23·0	20 27·9	20 31·5	20 30·2	20 28·1		
,, 22	13 56	17 8	G.S.J.	$\frac{1}{81}$	20 31·9	20 32·1	20 33·7	20 35·0	20 33·2	No. $\frac{2}{81}$	
,, 26	11 20	14 32	V.G.G.	$\frac{1}{81}$	20 31·9	20 30·9	20 35·7	20 38·5	20 34·2	° ′ 20 27·4	
,, 29	14 15	17 25	D.	$\frac{2}{81}$	20 28·6	20 23·6	20 32·0	20 25·2	20 27·3		

1892. Date.	Bombay Civil Time (0 to 24 hours). At commencement.	At conclusion.	Observer.	Needle marked.	End of Needle Dipping. A. Face of Circle. East.	A. Face of Circle. West.	B. Face of Circle. East.	B. Face of Circle. West.	Mean Dip.	Monthly Mean for each Needle.	Monthly Mean.
	h. m.	h. m.			° ′	° ′	° ′	° ′	° ′		° ′
MAY 3	11 12	14 24	G.S.J.	2/81	20 31·2	20 33·1	20 18·1	20 24·5	20 26·7		
,, 6	13 55	17 3	G.S.J.	1/81	20 38·1	20 36·8	20 32·5	20 36·7	20 36·0	No. 1/81	
,, 10	11 20	14 34	D.	1/81	20 31·1	20 32·7	20 31·7	20 42·2	20 34·4	° 20 35·1	
,, 13	14 35	17 53	D.	2/81	20 34·5	20 30·7	20 14·9	20 22·9	20 25·7		
,, 17	11 31	14 48	G.S.J.	2/81	20 30·9	20 34·1	20 23·9	20 24·9	20 28·4		20 30·9
,, 20	13 47	17 0	G.S.J.	1/81	20 33·0	20 33·9	20 35·0	20 38·5	20 35·1		
,, 23	11 35	14 56	D.	1/81	20 35·1	20 34·0	20 40·5	20 30·1	20 34·9	No. 2/81	
,, 27	13 45	17 5	V.G.G.	2/81	20 31·0	20 37·7	20 18·4	20 22·5	20 27·4	° 20 27·6	
,, 31	11 18	14 33	G.S.J.	2/81	20 38·9	20 30·1	20 25·9	20 24·9	20 29·9		
JUNE 3	13 58	17 13	G.S.J.	1/81	20 38·7	20 37·9	20 38·2	20 33·2	20 37·0	No. 1/81	
,, 7	11 25	14 30	V.G.G.	1/81	20 32·1	20 34·7	20 41·1	20 34·9	20 35·7	° 20 36·0	
,, 10	13 48	17 2	V.G.G.	2/81	20 33·9	20 38·4	20 26·0	20 22·2	20 30·1		
,, 14	11 28	14 35	V.G.G.	2/81	20 38·4	20 35·0	20 24·0	20 23·0	20 30·1		20 33·1
,, 17	13 45	17 0	V.G.G.	1/81	20 32·4	20 33·1	20 38·9	20 34·5	20 34·7		
,, 21	11 25	14 35	V.G.G.	1/81	20 37·2	20 33·0	20 38·6	20 37·5	20 36·6	No. 2/81	
,, 24	13 46	17 2	V.G.G.	2/81	20 37·0	20 38·9	20 23·4	20 24·6	20 31·0	° 20 30·2	
,, 28	11 20	14 36	G.S.J	2/81	20 39·9	20 35·4	20 20·2	20 23·5	20 29·7		
JULY 1	13 52	17 7	G.S.J.	1/81	20 34·7	20 38·1	20 34·5	20 36·9	20 36·0		
,, 5	11 25	14 36	V.G.G.	1/81	20 34·9	20 34·9	20 34·1	20 35·9	20 34·9	No. 1/81	
,, 8	13 55	17 5	V.G.G.	2/81	20 37·9	20 35·5	20 21·6	20 25·9	20 30·2	° 20 35·0	
,, 12	11 20	14 35	V.G.G.	2/81	20 31·2	20 34·1	20 21·7	20 28·2	20 28·8		
,, 15	13 56	17 4	V.G.G.	1/81	20 32·7	20 36·1	20 35·2	20 33·0	20 34·2		20 32·4
,, 19	11 25	14 35	V.G.G.	1/81	20 29·5	20 34·2	20 36·7	20 36·7	20 34·3		
,, 22	13 55	17 4	V.G.G.	2/81	20 25·6	20 33·7	20 25·4	20 33·6	20 29·6	No. 2/81	
,, 26	11 32	14 43	G.S.J.	2/81	20 22·7	20 35·0	20 23·4	20 30·4	20 27·9	° 20 29·1	
,, 29	13 50	17 5	G.S.J.	1/81	20 21·9	20 43·9	20 28·5	20 47·2	20 35·4		
AUG. 2	11 25	14 34	V.G.G.	1/81	20 24·0	20 44·2	20 29·1	20 39·6	20 34·2		
,, 5	13 53	17 15	V.G.G.	2/81	20 17·0	20 37·6	20 25·7	20 29·5	20 27·4	No. 1/81	
,, 9	11 25	14 42	G.S.J.	2/81	20 26·1	20 33·5	20 27·1	20 29·2	20 29·0	° 20 32·8	
,, 12	13 43	16 54	G.S.J.	1/81	20 33·4	20 35·2	20 34·7	20 30·9	20 33·5		
,, 16	11 20	14 33	V.G.G.	1/81	20 26·0	20 42·4	20 31·4	20 32·0	20 32·9		20 30·7
,, 19	13 50	17 2	V.G.G.	2/81	20 29·1	20 33·5	20 23·6	20 28·5	20 28·7		
,, 23	11 30	14 45	G.S.J.	2/81	20 44·2	20 24·4	20 21·9	20 20·2	20 27·7	No. 2/81	
,, 27	13 45	17 2	G.S.J.	1/81	20 37·1	20 33·5	20 29·4	20 29·2	20 32·3	° 20 28·2	
,, 30	11 20	14 30	V.G.G.	1/81	20 27·5	20 36·6	20 25·4	20 34·0	20 30·9		

1892. Date.	Bombay Civil Time (0 to 24 hours). At commencement.	At conclusion.	Observer.	Needle marked.	End of Needle Dipping. A. Face of Circle. East.	A. Face of Circle. West.	B. Face of Circle. East.	B. Face of Circle. West.	Mean Dip.	Monthly Mean for each Needle.	Monthly Mean.
	h. m.	h. m.			° ′	° ′	° ′	° ′	° ′		° ′
SEPT. 2	13 45	17 4	V.G.G.	2/81	20 37·4	20 29·1	20 18·7	20 19·5	20 26·2		
,, 6	11 26	14 46	D.	2/81	20 24·5	20 38·6	20 23·1	20 26·6	20 28·2		
,, 9	14 10	17 33	D.	1/81	20 24·5	20 47·2	20 16·7	20 30·7	20 29·8	No. 1/81	
,, 13	11 25	14 38	V.G.G.	1/81	20 20·5	20 45·2	20 15·2	20 35·0	20 29·0	° ′ 20 29·7	
,, 16	13 50	17 5	V.G.G.	2/81	20 15·4	20 53·4	20 19·5	20 21·5	20 27·4		20 28·6
,, 20	11 45	15 15	D.	2/81	20 23·9	20 49·4	20 0·1	20 41·7	20 28·8		
,, 23	14 11	17 36	D.	1/81	20 22·1	20 49·6	20 21·7	20 27·0	20 30·1	No. 2/81	
,, 27	11 27	14 35	V.G.G.	1/81	20 20·7	20 43·9	20 22·2	20 32·9	20 29·9	° ′ 20 27·8	
,, 30	13 50	17 1	V.G.G.	2/81	20 14·2	20 51·4	20 1·7	20 46·5	20 28·4		
OCT. 4	11 37	15 8	D.	2/81	20 24·0	20 44·0	20 5·0	20 42·5	20 28·9		
,, 7	14 13	17 39	D.	1/81	20 17·1	20 48·4	20 19·0	20 30·6	20 28·8	No. 1/81	
,, 11	11 20	14 35	V.G.G.	1/81	20 14·7	20 52·9	20 12·1	20 35·9	20 28·9	° ′ 20 30·0	
,, 14	13 50	17 3	V.G.G.	2/81	20 18·5	20 47·9	20 3·7	20 43·4	20 28·4		20 29·7
,, 17	12 0	15 5	D.	2/81	20 8·6	20 52·2	20 9·6	20 50·9	20 30·3		
,, 22	13 58	17 9	D.	1/81	20 14·5	20 53·0	20 18·0	20 40·2	20 31·4	No. 2/81	
,, 25	11 25	14 35	V.G.G.	1/81	20 8·7	20 48·7	20 18·6	20 48·4	20 31·1	° ′ 20 29·3	
,, 28	13 50	17 7	V.G.G.	2/81	20 6·2	20 49·7	20 10·1	20 51·9	20 29·5		
NOV. 1	11 45	15 13	D.	2/81	20 13·7	20 51·1	20 19·2	20 43·1	20 31·8		
,, 4	14 5	17 12	D.	1/81	20 11·9	20 48·7	20 20·1	20 51·1	20 32·9	No. 1/81	
,, 8	11 30	14 40	V.G.G.	1/81	20 9·9	20 50·7	20 17·0	20 52·1	20 32·4	° ′ 20 33·8	
,, 11	13 50	17 9	V.G.G.	2/81	20 10·1	20 55·4	20 16·0	20 43·6	20 31·3		
,, 15	11 10	14 25	D.	2/81	20 7·7	21 1·7	20 22·0	20 39·1	20 32·6		20 33·3
,, 18	14 0	17 12	D.	1/81	20 15·0	20 57·4	20 15·9	20 50·2	20 34·6		
,, 22	11 20	14 40	V.G.G.	1/81	20 13·4	20 51·7	20 22·7	20 53·1	20 35·2	No. 2/81	
,, 25	13 51	17 7	V.G.G.	2/81	20 10·1	20 58·6	20 25·5	20 41·4	20 33·9	° ′ 20 32·9	
,, 29	11 22	14 33	D.	2/81	20 17·1	20 55·0	20 15·6	20 51·0	20 34·7		
DEC. 2	13 29	16 55	D.	1/81	20 18·3	20 54·2	20 18·2	20 58·2	20 37·2		
,, 6	11 25	14 48	V.G.G.	1/81	20 13·2	20 56·7	20 20·2	20 58·2	20 37·1	No. 1/81	
,, 9	13 50	17 4	V.G.G.	2/81	20 7·4	20 58·2	20 17·1	20 53·7	20 34·1	° ′ 20 36·9	
,, 13	11 28	14 47	D.	2/81	20 17·1	21 0·7	20 14·2	20 46·5	20 34·6		
,, 16	13 49	17 8	D.	1/81	20 20·9	20 55·8	20 24·2	20 47·5	20 37·1		20 35·7
,, 20	11 33	14 42	V.G.G.	1/81	20 18·1	20 57·1	20 21·7	20 47·1	20 36·0		
,, 23	13 50	17 2	V.G.G.	2/81	20 12·6	21 2·1	20 15·1	20 44·2	20 33·5	No. 2/81	
,, 27	11 33	14 40	V.G.G.	2/81	20 10·2	21 4·5	20 15·7	20 47·6	20 34·5	° ′ 20 34·2	
,, 30	13 58	17 8	G.S.J.	1/81	20 18·3	20 52·4	20 19·1	20 57·9	20 36·9		

Mean Dip for the year. { With Needle No. 1/81 = ° ′ 20 33·7 ; With Needle No. 2/81 = 20 28·8

The Mean Dip for the year 1892 = ° ′ 20 31·3

BOMBAY

MAGNETICAL AND METEOROLOGICAL OBSERVATIONS,

1891 AND 1892.

Appendix.

THE SECULAR VARIATION OF MAGNETIC DIP AT BOMBAY

BY

CHARLES CHAMBERS, F.R.S.,
DIRECTOR OF THE COLA'BA OBSERVATORY, BOMBAY.

B 260—AP—a.

The Secular Variation of Magnetic Dip at Bombay during the years 1867 to 1892.

BY CHARLES CHAMBERS, F.R.S.

In the year 1867 the Colába Observatory was furnished—through the Kew Observatory Committee of the British Association—with a dip circle by Henry Barrow of London (No. 49), which has been in regular use at Colába ever since; and the observations taken with it, and with several 3½-inch needles, have been regularly published in the successive issues of "the Bombay Magnetical and Meteorological Observations."

2. The instrument consists of a horizontal circle (6 inch), reading by a vernier to *one minute*, and supporting a revolving plate which carries a 6-inch vertical circle with two verniers,—also reading to *one minute*,—and microscopes, and a pair of vertical pillars with Y's for lifting the needle. The pillars, with the needle, are enclosed in a mahogany box with glazed sides, front and back,—6 inches square—the back one of which forms a hinged door: and both pillars have vertical slots cut in them to admit of the lower point of the needle being observed when the needle is vertical. The Y's are fixed at the top of sliding pieces, which are moved simultaneously up and down grooves in the pillars by means of a milled screw-head outside the box. To the tops of the pillars are fixed two pieces of agate with horizontal rounded upper edges, upon which the axle of the needle rests at the moment of observation, whilst the needle is free when disturbed to swing between the pillars. The upper edges of the pieces of agate are adjusted to lie in the same horizontal plane; and the lifting slides and Y's so as just to raise the needle off the agates, but distinctly so, when at their upper limit of movement, and also to lift the needle simultaneously at both ends of the axle. The part of the axles of the needles upon which the needles rest is of cylindrical form (about ·018 inch in diameter), and has a highly polished surface. The horizontal circle carries a spirit level and has three screw feet for levelling. The vertical circle carries its microscopes—the fields of which are bisected by spider lines directed towards the centre of the circle—on the same arms as the verniers. Both circles have clamps and tangent screws for fine adjustment.

3. From April 29, 1867, to September 21, 1871, the spot at which the dip observations were made was on a large solid block of teakwood at the foot of the Electrometer Tower, and since the latter date in the top room of the same building, the dip circle having been placed on the same wooden pillar on which the Kew Unifilar magnetometer is placed in the regular observations of absolute horizontal force and absolute declination.

4. Having fixed the feet of the circle on the supporting pillar, and adjusted them for level, the upper vernier of the vertical circle is set at 90°, and a series of observations made to find what must be the reading of the horizontal circle when the magnetic axis of the needle swings in the vertical plane at right angles to the magnetic meridian plane. First, the horizontal circle is turned until the wire of the upper microscope bisects the upper end of the needle, and the horizontal circle is read; a reading is similarly made when the wire of the lower microscope bisects the lower end of the needle: these two readings are repeated with the face of the circle reversed in azimuth; the last four when the face of the needle is reversed in azimuth; and the last eight when the lower vernier is set at 90°; the mean of the sixteen readings is the reading sought; and as the horizontal circle is numbered from 0° to 90° successively, the same reading, but with the azimuth of the circle differing by 90°, will be that of the horizontal circle when the magnetic axis of the needle lies in the plane of the magnetic meridian. This observation has been repeated from time to time.

5. A regular observation consists of the following operations:—

1st.—Having set the horizontal circle to the adopted azimuthal reading, with the face of the vertical circle to eastward, the verniers are turned until the wire of the upper microscope bisects the upper end of the needle, and the upper vernier is then read.

2nd.—The wire of the lower microscope is similarly made to bisect the lower end of the needle and the lower vernier is read.

Similar readings are taken for different positions of the circle and needle as shown (including the above) in the following form and in the order there indicated :—

TABLE I.

Poles of needle.	One end dipping.								The other end dipping.							
Circle facing	East.				West.				East.				West.			
Needle facing	East.		West.		East.		West.		East.		West.		East.		West.	
End of needle observed.	Upper.	Lower.	Upper.	Lower.	Upper.	Lower.	Upper.	Lower.	Upper.	Lower.	Upper.	Lower.	Upper.	Lower.	Upper.	Lower.
Order of observation—as to time.	1	2	13	14	9	10	5	6	17	18	29	30	25	26	21	22
	3	4	15	16	11	12	7	8	19	20	31	32	27	28	23	24

6. After setting approximately, the needle is lifted several times and the tangent screw turned until a position of the microscope wire is gained, about which—as a mean position—the needle oscillates consistently after repeated liftings; this position is then adopted without the observer knowing what the reading of the vernier will be, and the actual reading is entered regardless of what may be the final result of the observation. The needle is not let down with extreme gentleness, but—at the moment before touching the agate supports—rather smartly.

The mean of the 32 readings is taken as the result of the whole observation.

7. To magnetize the needle, ten passes are made, on each side, with a pair of large bar magnets: the needle is then wiped with a clean linen cloth, and the axle, which is made to pierce a fine cork, is rubbed with the cork; the needle is then examined to see that no particles of fluff or cork remain on it, when it is placed on the agate supports. This practice continued till the end of 1876, after which the axle of the needle was finally rubbed with a clean silk cloth. The linen and silk cloths and corks used are kept, the former in a box with cover, and the latter in an air-tight vessel, the air in which is kept dry by the exposure in it of some pieces of quicklime.

8. The observations were taken generally on Tuesday morning and Friday afternoon or *vice versâ* with one needle, and on the following Tuesday and Friday or *vice versâ* with the other needle, and so on alternately.

9. Great care—which is especially needful during the monsoon—has been taken to protect the needles from rust by surrounding them with a dry atmosphere. The importance of attention being given to this point, being known beforehand, the air-tight packing with which the needles had been provided before leaving the Kew Observatory was not removed until a suitable case had been provided for their preservation. This case consisted of a circular slab of teakwood with a deep groove cut near its periphery partially filled with mercury, and an inverted bell-glass, whose rim fitted the groove, floating on the mercury. In this receptacle (or such a one), which also contained a vessel of (frequently renewed) quicklime for drying the air, the needles have been always kept when not in use.

10. Up to the 17th August 1867, the observations commenced with either end (A or B) of the needle dipping and without re-magnetizing the needle, *i.e.* the magnetization for the latter half of one observation was made to serve for the first half of the next observation with the same needle, and the two needles were kept during the interval with contrary poles adjacent in a zinc box: but after August 17, 1867, the needle was always re-magnetized so as to make the end "A" dip during the first half of the observation.

11. The dip circle was taken to pieces and thoroughly cleaned and re-adjusted between October 8 and 10, 1881; again between December 10 and 17, 1887; and once more between December 10 and 30, 1888. The agate planes were renewed on the 2nd January 1877, were raised a little on the 28th January 1877, and one was lowered a little on the 10th October 1881; and of the lifting Y's one was flattened and re-adjusted on the 23rd and 24th January 1871, and both were re-adjusted in 1887 and 1888.

12. The following is a list of the several needles that have been observed with, and of the periods of use of each of them :—

TABLE 2.

NEEDLE. Number and maker's name.	Period of use.
No. 2 by Barrow	From 29th April 1867 to 19th September 1871.
No. 1 by Barrow	„ 30th April 1867 to 19th March 1869.
No. 13 by Adie	„ 6th June 1870 to 6th June 1871.
No. 18 by Adie	On 21st September 1871.
No. 1 by John Dover	From 22nd September 1871 to 29th December 1876.
No. 2 by John Dover	From 23rd September 1871 to 26th December 1876.
No. 2 by John Dover (after repolishing of axle).	From 7th October 1881 to 25th December 1888.
No. 19 by Adie	On 3rd and 6th November 1871.
No. 5 by Adie	From 3rd January 1877 to 25th November 1881 and from 3rd January to 28th December 1888.
No. $\frac{2}{31}$ by John Dover	From 4th October 1881 to 27th December 1892.
No. $\frac{1}{31}$ by John Dover	From 6th January 1888 to 30th December 1892.
No. 2 by Dover, Charlton	From 1st January 1889 to 27th December 1892.
No. 1 by Dover, Charlton	From 4th January 1889 to 30th December 1892.

13. An account is given in the Philosophical Transactions, Vol. 166, Part I of the earlier years of these observations, from which it appears—amongst other things—that the probable error of a single determination of dip was somewhat less, during each of three successive periods between April 29, 1867 and December 31, 1868, than one minute of arc.*

14. The axle of the needle by Barrow No. 1 was accidentally broken in March 1869, and a year later the observations with the needle by Barrow No. 2 began to be of inferior character, the range within which lay the extreme positions at which the needle was left on several successive liftings being much widened; and it must be confessed that to this day the same order of consistency of behaviour has never again been displayed by any of the needles used in later years, a fact which I can only attribute to the death of the artist, who produced the original needles, and to a suspicion that his successors in the field have failed to re-discover some secret process in the polishing of the axles and agate planes that he probably discovered and never divulged.

15. Nevertheless there has been improvement with growing experience, as will be seen by the following table, which exhibits the annual means of all the values of dip obtained in each year with each needle, and the greatest and least of the values observed in each year; for the departures from the mean values are generally larger in the middle years than during the earlier and later years.

TABLE 3.

Needle.	Year or Epoch.	Number of Observations.	Least.	Greatest.	Mean.	Increment.
			° ′	° ′	° ′	′
No. 2, by Barrow ...	1867·7	36	19 1·3	19 6·2	19 3·2	
						+1·30
„ ...	1868·5	52	19 3·2	19 5·2	19 4·5	
						+1·30
„ ...	1869·5	94	18 44·9	19 7·7	19 5·8	
						+1·70
„ ...	1870·5	93	18 52·4	19 15·4	19 7·5	
						−1·60
„ ...	1871·4	33	18 55·3	19 14·0	19 5·9	

*The Absolute Direction and Intensity of the Earth's Magnetic Force at Bombay, page 78.

TABLE 3—*continued.*

Needle.	Year or Epoch.	Number of Observations.	Least.	Greatest.	Mean.	Increment.
			° ′	° ′	° ′	′
No. 1, by Barrow ...	1867·7	38	18 56·5	19 6·1	19 1·1	
						+2·20
„ ...	1868·5	52	19 1·9	19 4·1	19 3·3	
„ ...	1869·1	16	19 2·4	19 17·3	19 5·5	
No. 13, by Adie ...	1870·7	38	18 51·1	19 17·8	19 6·9	
„	1871·2	40	18 42·8	19 30·7	19 9·3	
No. 18, by Adie ...	1871·7	1			19 21·6	
No. 1, by John Dover...	1871·9	16	19 3·4	19 17·9	19 10·6	
						+3·10
„ ...	1872·5	52	19 5·8	19 19·2	19 13·7	
						+1·10
„ ...	1873·5	52	19 9·2	19 20·4	19 14·8	
						−0·80
„ ...	1874·5	52	19 10·2	19 17·2	19 14·0	
						−2·90
„ ...	1875·5	53	19 6·1	19 14·6	19 11·1	
						−1·00
„ ...	1876·5	52	18 57·9	19 14·5	19 10·1	
No. 2, by John Dover ...	1871·9	14	19 4·2	19 14·9	19 10·9	
						+3·30
„ ...	1872·5	53	19 8·7	19 17·8	19 14·2	
						+0·40
„ ...	1873·5	52	19 11·3	19 18·5	19 14·6	
						+0·60
„ ...	1874·5	52	19 12·6	19 18·5	19 15·2	
						+0·20
„ ...	1875·5	52	19 12·9	19 18·6	19 15·4	
						−2·00
„ ...	1876·5	52	19 9·8	19 31·4	19 13·4	
No. 19, by Adie ...	1871·8	2	19 5·0	19 10·1	19 7·5	
No. 5, by Adie ...	1877·5	105	19 14·4	19 29·3	19 20·2	
						−0·20
„ ...	1878·5	105	19 13·5	19 24·6	19 20·0	
						+2·20
„ ...	1879·5	104	19 14·9	19 24·9	19 22·2	
						−0·70
„ ...	1880·5	105	19 15·5	19 25·7	19 21·5	
						−1·10
„ ...	1881·4	79	19 15·3	19 24·9	19 20·4	
„ ...	1881·8	7	19 37·1	19 43·3	19 40·0	
No. $\frac{5}{81}$, by John Dover .	1881·9	13	19 41·4	19 47·1	19 44·6	
						+0·60
„ ...	1882·5	52	19 42·0	19 48·5	19 45·2	
						+2·60
„ ...	1883·5	52	19 44·0	19 50·7	19 47·8	
						−0·30
„ ...	1884·5	52	19 44·9	19 50·$\frac{5}{8}$	19 47·5	
						+1·50
„ ...	1885·5	52	19 47·4	19 50·6	19 49·0	
						−0·90
„ ...	1886·5	53	19 46·9	19 49·2	19 48·1	
						+1·60
„ ...	1887·5	50	19 47·0	19 56·4	19 49·7	

TABLE 3—*continued.*

Needle.	Year or Epoch.	Number of observations.	Least.	Greatest.	Mean.	Increment.
			° ′	° ′	° ′	
No. $\frac{2}{81}$, by John Dover .	1888·0	2	20 5·6	20 10·1	20 7·8	
						+5·40
„ ...	1888·5	52	20 6·2	20 20·6	20 13·2	
						+3·00
„ ...	1889·5	53	20 5·7	20 22·0	20 16·2	
						+4·20
„ ...	1890·5	52	20 16·3	20 26·4	20 20·4	
						+5·10
„ ...	1891·5	52	20 20·6	20 29·0	20 25·5	
						+3·30
„ ...	1892·5	52	20 25·8	20 34·2	20 28·8	
No. 2, by John Dover .	1881·9	13	19 38·6	19 45·6	19 42·5	
						−2·10
„ ...	1882·5	52	19 34·8	19 43·8	19 40·4	
						−1·50
„ ...	1883·5	52	19 36·8	19 42·6	19 38·9	
						+3·60
„ ...	1884·5	53	19 39·7	19 45·4	19 42·5	
						+1·20
„ ...	1885·5	52	19 41·0	19 46·6	19 43·7	
						−0·10
„ ...	1886·5	52	19 42·3	19 44·9	19 43·6	
						−1·00
„ ...	1887·5	50	19 34·0	19 48·7	19 42·6	
„ ...	1888·0	2	20 3·8	20 6·3	20 5·0	
						+3·00
„ ...	1888·5	52	20 1·3	20 29·0	20 8·0	
No. 5, by Adie ...	1888·5	52	20 0·8	20 31·6	20 9,6	
No. $\frac{1}{81}$, by John Dover .	1888·5	52	20 7·8	20 18·9	20 12·6	
						+7·20
„ ...	1889·5	52	20 13·1	20 25·7	20 19·8	
						+4·00
„ ...	1890·5	52	20 18·3	20 29·5	20 23·8	
						+5·00
„ ...	1891·5	52	20 25·2	20 30·7	20 28·8	
						+5·00
„ ...	1892·5	53	20 29·7	20 36·9	20 33·8	
No. 2, by Dover, Charlton	1889·5	53	20 15·2	20 21·8	20 18·8	
						+5·20
„ ...	1890·5	52	20 19·4	20 28·0	20 24·0	
						+5·10
„ ...	1891·5	52	20 26·8	20 31·5	20 29·1	
						+3·60
„ ...	1892·5	52	20 28·9	20 36·6	20 32·7	
No. 1, by Dover, Charlton	1889·5	52	20 15·1	20 25·8	20 19·1	
						+4·40
„ ...	1890·5	52	20 17·9	20 27·2	20 23·5	
						+5·30
„ ...	1891·5	52	20 26·0	20 31·6	20 28·8	
						+5·10
„ ...	1892·5	53	20 31·0	20 35·7	20 33·9	

16. The numbers of this table are curved, with years as abscissæ and amounts of dip as ordinates, in Figures 1 to 12 and 15, a separate curve being drawn to show the changes of dip obtained by each needle. The first thing that strikes one in considering these curves is the general steady growth of the annual means, which implies that on the whole the compensation of erratic values of opposite deviation from the mean is, in a year, fairly complete. And a second feature that calls for explanation, is the sudden rise in the values of dip—of 20′ to 30′—that takes place in 1881 and 1887, on both which occasions the dip circle was taken to pieces and cleaned, and the parts re-adjusted, and this—whether regard be had to the continued observations, before and after the re-building of the circle, of identical needles, or of different needles. I can give no satisfactory account of this behaviour of the instrument, but—merely as a suggestion—I may say that as the needle is made to rest on the same very small part of the agate planes in a long series of successive observations, it may possibly be that its pressure—which reckoned per square foot of surface would be very great—is sufficient to produce a small depression in the agate, and so to impede the tendency of the needle to roll on its axle up the sides of the depression. Thus the range of the secular variation would be contracted so long as the adjustments of the circle were undisturbed, and immediately a new position of rest on the agate planes resulted from a change of adjustment, a sudden movement would take place in the way of extension of the contracted range, and this is what really happens. It may be remarked also that a similar sudden rise took place, though of smaller amount, at the beginning of 1877, when the agate planes were renewed; and the absence of any marked rise in December 1888, when the Y's were re-adjusted, could be accounted for if, by chance, the re-adjustment left the Y's and the planes very exactly in the same relative position, or by the interval of a year being insufficient for the formation of a depression on the agates.

17. Having thus hit upon a working hypothesis to account for the sudden jumps in the amount of absolute dip shown at certain epochs in the whole series of observations and for the supposed contraction of the range of growth during the intervals between those epochs, we notice from the general approach to parallelism of the curves between 1867·7 and 1871·4, 1871·9 and 1876·5, 1881·9 and 1887·5 and between 1888·0 and 1892·5, whatever be the needles whose indications are represented, that the curves tell generally the same tale about the growth of the contracted range from year to year; and it thereby becomes permissible to group together the values of this growth for any individual yearly interval obtained from the observations of all the needles that were in use in that year, and to take an average of the group as representing more exactly than the values given by the individual needles the amount of this contracted annual growth. In Table 4 are extracted the increments of dip shown in Table 3 for each of the annual or approximately annual intervals, and the calculated values of the mean increments; and the latter being added together successively, and the sums increased by the observed value of the dip for the initial epoch of each period, give the integral values of the dip shown in the last column of the table; and these are curved in the five strong-line Figures 13 to 17.

TABLE 4.

Between Epochs.	Increments of Dip. Needles marked.										Mean Increment.	Year or Epoch.	Integral Dip.
	No. 3 by Barrow	No. 1 by Barrow.	No. 13 by Adie.	No. 1 by Dover.	No. 2 by Dover.	No. 5 by Adie.	No. 1′ by John Dover.	No. 1′ by John Dover.	No. 1 by Dover, Charlton.	No. 2 by Dover, Charlton.			
													° ′
1867·7 and 1868·5 ...	+1′30	+2′20									+1′75	1867·7	19 2′15
1868·5 and 1869·5 ..	+1′30										+1′30	1868·5	19 3′90
1869·5 and 1870·5 ...	+1′70										+1′70	1869·5	19 5′20
1870·5 and 1871·4 ...	−1′60										−1′60	1870·5	19 6′90
												1871·4	19 5′30

TABLE 4—*continued.*

Between Epochs.	Increments of Dip. Needles marked. No. 2 by Barrow.	No. 1 by Barrow.	No. 13 by Adie.	No. 1 by Dover.	No. 2 by Dover.	No. 5 by Adie.	No. 4½ by John Dover.	No. 4½ by John Dover.	No. 1 by Dover Charlton.	No. 2 by Dover Charlton.	Mean Increment.	Year or Epoch.	Integral Dip.
				′	′								a ° ′
1871·9 and 1872·5 ...				+3·10	+3·30						+3·20	1871·9	19 10·75
1872·5 and 1873·5 ...				+1·10	+0·40						+0·75	1872·5	19 13·95
1873·5 and 1874·5 ...				−0·80	+0·60						−0·10	1873·5	19 14·70
1874·5 and 1875·5 ...				−2·90	+0·20						−1·35	1874·5	19 14·60
1875·5 and 1876·5 ...				−1·00	−2·00						−1·50	1875·5	19 13·25
												1876·5	19 11·75
						′							a
1877·5 and 1878·5 ...						−0·20					−0·20	1877·5	19 20·20
1878·5 and 1879·5 ...						+2·20					+2·20	1878·5	19 20·00
1879·5 and 1880·5 ...						−0·70					−0·70	1879·5	19 22·20
1880·5 and 1881·4 ...						−1·10					−1·10	1880·5	19 21·50
												1881·4	19 20·40
							′						a
1881·9 and 1882·5 ...					−2·10		+0·60				−0·75	1881·9	19 43·55
1882·5 and 1883·5 ...					−1·50		+2·60				+0·55	1882·5	19 42·80
1883·5 and 1884·5 ...					+3·60		−0·30				+1·65	1883·5	19 43·35
1884·5 and 1885·5 ...					+1·20		+1·50				+1·35	1884·5	19 45·00
1885·5 and 1886·5 ...					−0·10		−0·90				−0·50	1885·5	19 46·35
1886·5 and 1887·5 ...					−1·00		+1·60				+0·30	1886·5	19 45·85
												1887·5	19 46·15
													a
1888·0 and 1888·5 ...					+3·00		+5·40				+4·20	1888·0	20 6·40
1888·5 and 1889·5 ...							+3·00	+7·20			+5·10	1888·5	20 10·60
1889·5 and 1890·5 ...							+4·20	+4·00	+4·40	+5·20	+4·45	1889·5	20 15·70
1890·5 and 1891·5 ...							+5·10	+5·00	+5·30	+5·10	+5·12	1890·5	20 20·15
1891·5 and 1892·5 ...							+3·30	+5·00	+5·10	+3·60	+4·25	1891·5	20 25·27
												1892·5	20 29·52

a, a, a, a, a Mean Dip for initial epoch.

18. And now comparing these curves with the curve, Fig. 15,* of secular variation of absolute horizontal force, we notice that upon the general increase of dip and of horizontal force alike is superimposed a remarkable inverse movement, of subordinate magnitude, that reaches its limit in 1882 and commences and ends in 1879 and 1884 or 1885 respectively, a movement that might be suspected of being of instrumental origin if

* Bombay Magnetical and Meteorological Observations, 1890, Appendix, Plate II.

it appeared in the dip observations alone, but that having a distinct counterpart in one component of the intensity of the earth's magnetism, implies that there is a similar but exaggerated movement in the other, the vertical, component of the intensity. For if X and Y represent the respective components and θ the dip, we have

$$\frac{Y}{X} = tan\theta$$

$$\frac{XdY - YdX}{X^2} = \frac{d\theta}{cos^2\theta}$$

$$\frac{dY}{X} - \frac{Y}{X}\frac{dX}{X} =$$

$$cos^2\theta \ \frac{dY}{X} - cos^2\theta \ tan\theta \ \frac{dX}{X} = d\theta$$

$$cos^2\theta \ \frac{dY}{X} - \tfrac{1}{2} sin\ 2\theta \ \frac{dX}{X} = d\theta$$

$$cos^2\theta \ \frac{dY}{X} = d\theta \ + \tfrac{1}{2} sin\ 2\theta \frac{dX}{X}$$

$$\frac{cos^2\theta}{sin1'} \ \frac{dY}{X} = \frac{d\theta}{sin1'} + \frac{sin\ 2\theta}{2\ sin1'} \ \frac{dX}{X}$$

which expresses, for the case in question, the change of dip that arises from changes dY of the vertical force, so far as these depend on the contracted variation of absolute dip and on the variation (dX) of horizontal force. The data for the calculation of the two terms of this equation and their sums are given in Table 5, the last column of which shows the integral growth of the sums from the beginning to the end of each period of undisturbed observations, or during which the adjustment of the Y's and agate planes remained unchanged.

TABLE 5.

Year or Epoch.	Absolute Horizontal Force.		Dip.		$\frac{Sin\ 2\theta}{2\ sin\ 1'} \frac{dX}{X}$.	$\frac{d\theta}{sin\ 1'} + \frac{sin\ 2\theta}{2\ sin\ 1'} \frac{dX}{X}$.	Integral Dip due to increments of Vertical Force.
	Mean.	Increment.	Increment in Minutes.	Integral.			
	X.	dX.	$\frac{d\theta}{sin\ 1'}$.				
1	2	3	4	5	6	7	8
			′	° ′	′	′	′
1867·7...	3·7128			19 2·15			0·00
1868·5...	3·7146	+·0018	+1·75	19 3·90	+0·52	+2·27	+2·27
1869·5...	3·7163	+·0017	+1·30	19 5·20	+0·48	+1·78	+4·05
1870·5...	3·7183	+·0020	+2·70	19 6·90	+0·58	+2·28	+6·33
1871·4...	3·7202	+·0019	−1·60	19 5·30	+0·55	−1·05	+5·28
1871·9...	3·7211			19 10·75			0·00
1872·5...	3·7222	+·0011	+3·20	19 13·95	+0·31	+3·51	+3·51
1873·5...	3·7251	+·0029	+0·75	19 14·70	+0·83	+1·58	+5·09
1874·5...	3·7280	+·0029	−0·19	19 14·60	+0·83	+0·73	+5·82
1875·5...	3·7307	+·0027	−1·35	19 13·25	+0·79	−0·56	+5·26
1876·5...	3·7330	+·0023	−1·50	19 11·75	+0·65	−0·85	+4·41

TABLE 5—*continued.*

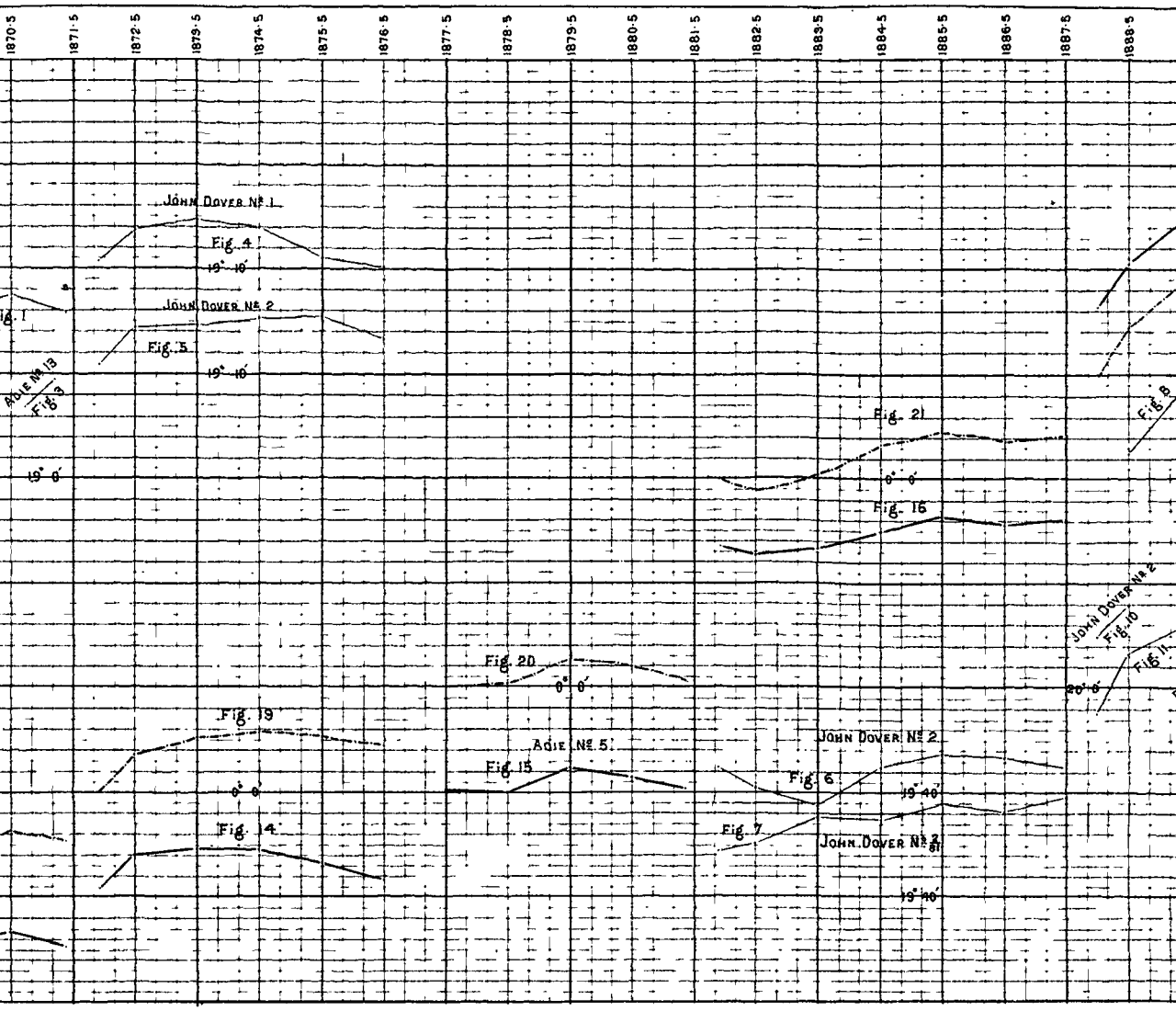
Year or Epoch.	Absolute Horizontal Force.		Dip.		$\frac{Sin\ 2\theta}{2\ sin\ 1'} \frac{dX}{X}$	$\frac{d\theta}{sin\ 1'} + \frac{sin\ 2\theta}{2\ sin\ 1'} \frac{dX}{X}$	Integral Dip due to increments of Vertical Force.
	Mean.	Increment.	Increment in Minutes.	Integral.			
	X.	dX.	$\frac{d\theta}{sin\ 1'}$.				
1	2	3	4	5	6	7	8
			′	° ′	′	′	′
1877·5	3·7339			19 20·20			0·00
		+·0014	−0·20		+0·41	+0·21	
1878·5	3·7353			19 20·00			+0·21
		+·0012	+2·20		+0·34	+2·54	
1879·5	3·7365			19 22·20			+2·75
		−·0003	−0·70		−0·10	−0·80	
1880·5	3·7362			19 21·50			+1·95
		−·0006	−1·10		−0·17	−1·27	
1881·4	3·7356			19 20·40			+0·68
1881·9	3·7348			19 43·55			0·00
		−·0011	−0·75		−0·31	−1·06	
1882·5	3·7337			19 42·80			−1·06
		+·0035	+0·55		+1·03	+1·58	
1883·5	3·7372			19 43·35			+0·52
		+·0039	+1·65		+1·13	+2·78	
1884·5	3·7411			19 45·00			+3·30
		−·0003	+1·35		−0·10	+1·25	
1885·5	3·7408			19 46·35			+4·55
		−·0005	−0·50		−0·14	−0·64	
1886·5	3·7403			19 45·85			+3·91
		+·0003	+0·30		+0·10	+0·40	
1887·5	3·7406			19 46·15			+4·31
1888·0	3·7411			20 6·40			0·00
		+·0006	+4·20		+0·17	+4·37	
1888·5	3·7417			20 10·60			+4·37
		+·0007	+5·10		+0·21	+5·31	
1889·5	3·7424			20 15·70			+9·68
		+·0006	+4·45		+0·17	+4·62	
1890·5	3·7430			20 20·15			+14·30
		−·0010*	+5·12		−0·31	+4·81	
1891·5	3·7420			20 25·27			+19·11
		−·0019*	+4·25		−0·58	+3·67	
1892·5	3·7401			20 29·52			+22·78

* It was remarked in the Appendix to the Bombay Magnetical and Meteorological Observations, 1890, page [13] that the curve of Fig. 15 of the plate attached to the same exhibited a general tendency towards a coming maximum of the great secular period. That tendency, it will be observed, from the signs of the increments of horizontal force for 1891 and 1892, became an accomplished fact in 1890.

19. Five curves representing these integral growths appear—in dots and dashes—as Figs. 18 to 22 and—as stated above—they are necessarily of similar form, but with exaggerated scale, to the five curves—in strong lines—for the respective periods of secular variation of dip. That the dip instrument, which after long use is capable, under change of adjustment, of yielding absolute values of the dip that differ from those obtained immediately before by so much as half a degree, should nevertheless be competent to give a distinct record of niceties in the secular variation of this order, is to me, I confess, an unexpected result: it is, however, led up in a natural way by the observations themselves; and it is merely corrective of the groundless impression first entertained that because, under certain conditions, values may be obtained of the absolute dip that differ largely from each other, those differences are of the nature and order of a probable error of observation due to instrumental defects, whereas, in fact, they are of the nature of constant index errors that change with change of adjustment, whilst the actual probable error, under a constant adjustment, is a quantity of much smaller magnitude. A glance at the Figs. 13 to 17 of secular variation and consideration of their systematic flow in comparison with the general magnitude of the sudden jumps that separate them, is sufficient—without calculation—to render this obvious. That the characteristic of the dip circle here alluded to has not before been called attention to arises, I conceive, from the very proper caution which the magnetic observer exercises not unnecessarily to interfere with the adjustments of his instruments so long as all is apparently working well; and it might have remained unnoticed at Colába if the needles had in other respects behaved uniformly well throughout the period of observation.

COLABA OBSERVATORY.

SECULAR VARIATION OF MAGNETIC DIP.



E SAME FOR ALL THE FIGURES.

CH OF THE CURVES IS PLACED IMMEDIATELY BELOW IT — THUS 19° 10′; 0° 0′; &C., EXCEPT THAT THE SCALE OF FIGS. 13 TO 17 IS GIVEN, ON THE LEFT SIDE, IN ABSOLUTE VALUES OF THE DIP

DRAWN & LITHO. GOVT. PHOTOZINCO. OFFICE, POONA 1899.

MAGNETICAL AND METEOROLOGICAL OBSERVATIONS

MADE AT THE

GOVERNMENT OBSERVATORY, BOMBAY,

1893.

MAGNETICAL AND METEOROLOGICAL OBSERVATIONS

MADE AT THE

GOVERNMENT OBSERVATORY, BOMBAY,

IN THE YEAR 1893

UNDER THE DIRECTION OF

CHARLES CHAMBERS, Esq., F.R.S.,

AND

CHARLES CHAMBERS, JUNIOR, Esq., A.M.INST.C.E.

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1894.

TABLE OF CONTENTS.

PAGE

INTRODUCTION TO THE METEOROLOGICAL AND MAGNETICAL OBSERVATIONS, 1893.

Thirty-second number of the series ... i.
Geographical position of Observatory ... id.
Local situation ... id.
Directorship of the Observatory ... id.
Observatory Establishment ... id.
System of observation and reduction and distribution of duties ... ii.
Eye-observations subsidiary to continuous registrations of automatic instruments ... iii.
Instruments and phenomena observed five times a day ... id.
Other routine operations ... iv.

REMARKS ON THE CONDITION AND ADJUSTMENTS OF THE INSTRUMENTS AND ON THE PROCESSES OF REDUCTION ... id.

I.—METEOROLOGICAL INSTRUMENTS, 1893.

BAROMETER, description of ... id.
Error in setting the zero point of the scale, and change of method of observation ... v.
Corrections applied to the observed readings ... vi.
Comparison with the Kew Standard Barometer ... id.
GROUND THERMOMETERS ... vii.
THE ROBINSON-BECKLEY ANEMOGRAPH, description of ... id.
Tabulation of Anemograms ... viii.
Method of reduction ... id.
NEWMAN'S RAIN GAUGE ... ix.
BAROGRAPH AND THERMOGRAPH ... x.
PRESSURE OF VAPOUR.
Pressure of Vapour and additional capacity of the Air ... id.
Table I.—Regnault's values of the Pressure of Vapour at different Temperatures ... id.
SELF-REGISTERING RAIN GAUGE ... xi.
New syphon of modified form ... id.
Constants for converting syphon discharges into inches of rain-fall ... id.
Measurement and distribution of syphon discharges ... id.
Determination of scale of rain-fall ordinates ... xii.

DESCRIPTION OF THE TABLES OF METEOROLOGICAL RESULTS AND OF THE PROCESSES OF REDUCTION, 1893.

Barometric Pressure ... id.
Temperature of the Air, &c. ... id.
Monthly and annual range of variation of Meteorological Elements ... xiii.

NOTES ON INSTRUMENTAL CHANGES AND ON ALL IRREGULARITIES OR DEPARTURES FROM THE ROUTINE OF OBSERVATION OR REDUCTION, 1893.

Robinson-Beckley Anemograph ... id.
Barograph ... xiv.
Thermograph dry-bulb ... id.
Thermograph wet-bulb ... id.
Self-registering Rain Gauge ... id.

II.—MAGNETICAL INSTRUMENTS, 1893.

Kew Absolute Declinometer and Deflection and Vibration Apparatus ... id.
Kew Dip Circle ... xv.

Tables of Results derived from the Continuous Registrations of Automatic Meteorological Instruments and from Meteorological Observations, 1893.

		1893. Table.	Page.
Daily Means of	Barometric Pressure	I	2
	Temperature of the Air	II	3
	Pressure of Vapour	III	4
	Additional Capacity of the Air	IV	5
Individual observations in each Month of the Year, which showed the greatest and the least values of the following elements, *viz.*, Height of Barometer, corrected for Temperature; Temperature of Air; Pressure of Vapour; and Additional Capacity of Air		V	6
Daily.	Total Fall of Rain (in inches) as measured by F. Chambers's Self-registering Gauge, the funnel of which is 28 feet above the ground	VI	7
Mean Velocities of the North or South and East or West Components of the Winds which blew on each Day of the Year		VII	8
Mean Velocity of the Wind, in miles per hour, without regard to the direction from which it blew for each day of Bombay Civil Time; also the Mean Monthly Velocity, and its Variation from the Mean of the Year		VIII	9
Sums of the Velocities, and the Mean Velocities, in miles per hour, of the Winds which blew in each Month, from each of the sixteen Principal Directions; and also the number of observations which those sums comprise; the latter numbers indicating the Relative Frequency of the same Wind (as to direction) in the several months, and of different Winds during the same month		IX	10

Tables of Results derived from the Meteorological Observations made daily at 6, 10, 14, 16 and 22 hours, 1893.

		1893. Table.	Page.
Monthly Mean Temperature of the Ground, and its Annual Variation, at the respective depths of 1, 9, 20, 60 and 132 inches below the surface		X	12
Extent of Cloudy Sky—mean of estimations made at 6, 10, 14, 16 and 22 hours daily, the whole sky being reckoned as 10		XI	13
Daily.	Total Fall of Rain (in inches) as measured by Newman's Gauge, placed 4½ feet above the ground	XII	14
Five-Day Means, 1893		XIII	15

Tables of Results of Absolute Magnetical Observations, 1893.

	1893. Table.	Page.
Observations of Vibration and Deflection, taken with the Kew Unifilar Magnetometer (No. 23, by Elliot Brothers), for the determination of Absolute Horizontal Force	I	(3)
Observations of Absolute Declination	II	(6)
Observations of Inclination, taken with Barrow's Dip Circle, with Microscopes, No. 49 and two 3½-inch Needles	III	(7)
Supplementary Observations of Inclination, taken with Barrow's Dip Circle, with Microscopes, No. 49 and two 3½-inch Needles	III *a*	(10)

INTRODUCTION

TO THE

METEOROLOGICAL AND MAGNETICAL OBSERVATIONS,

1893.

Of the series of books entitled "Bombay Magnetical and Meteorological Observations" the present one is the thirty-second, extending the record, which before embraced the years 1845 to 1892, up to 1893.

2. The latitude and longitude of the Colába Observatory are 18° 53′ 45″ North and 72° 48′ 56″ East respectively.

3. *Local situation.*—The Observatory is situated at the extremity of a narrow strip of land extending two miles to the south-westward of the Fort of Bombay and separating the harbour and Back Bay. Trap rock, which is very abundant in the ground near and on the surrounding sea-beach, crops up at many places through the red sandy soil which covers the greater part of the Observatory enclosure. During the rainy months of the year, the soil is overgrown with grass, which, however, is quickly burned up when the dry season comes round. The nearest elevated ground is Malabár Hill, which lies on the opposite side of Back Bay, at a distance of four miles, but that which subtends the largest vertical angle, as seen from the Magnetical and Meteorological Observatory, is the southern hill of the Island of Karanja, at a distance of about eight miles across the harbour. The altitude of the highest point of the latter is less than 1° 7′. An idea of the aspect and nature of the surrounding country, and of the exposure of the thermometer shed and anemograph, may be obtained by inspection of the photographs—forming a series of panoramic views all round the compass, together with some near views of the buildings and instruments—which accompanied the "Meteorology of the Bombay Presidency" published in 1878. In the same work will be found a plan of the grounds and buildings of the Observatory, and an index showing the names and uses of the several buildings, and the location of trees of large and small growth.

The buildings concerned with the production of the observations recorded herein are, (1) the Astronomical Observatory and the Anemometer Tower, with a western wing, the greater part of which serves as a computing-rooni, whilst the remainder is partitioned off for a photographic operating room; (2) the Magnetical Observatory with the adjoining Electrometer Tower; (3) the underground Magnetograph room; and (4) the Thermograph Shed, enclosing the thermograph room; to which may be added the old thermometer shed.

4. *Directorship of the Observatory.*—The observations of the year 1893 were taken under the direction of Mr. Charles Chambers, F.R.S., except during the period April 20 to June 19, 1893, when the acting Directorship was held by Mr. Charles Chambers, Junior, A.M.Inst.C.E.

5. *Observatory Establishment.*—In the Magnetical Department of the Observatory there are one First Assistant, one Second Assistant, three Observers and one Computer; and in the Astronomical Department one First Assistant and one Second Assistant. These several offices were filled, during the year 1893, in the manner exhibited in the following statement:—

Name of Officer.	Department.	Name of Office.	Initial
Vináyak Náráyan Nene ...	Magnetical	First Assistant ...	V. N.
Ganesh Sadáshiv Joshi ...	Do.	Second Assistant .	G. S. J.
Shitárám Vithal Bendarkar ...	Do.	Observer ...	S.
Vithal Govind Ghanekar...	Do.	Do.	V. G. G.
Náráyen Sakhárám Kelkar ...	Do.	Do.	N.
Laxuman Balvant Cháphekar ...	Do.	Computer...	L.
Parsharám Laxuman Dátar ...	Astronomical	First Assistant ...	P.
Dámodar Wáman Sáthaye ...	Do.	Second Assistant .	D.

The initials marked in the last column are those which the respective observers attach to the several observations made by them.

Vacancies caused by the absence on leave of permanent employés were filled on different occasions by—

Bhálchandra Krishna Fagre (Initial B.C.)

6. *System of observation and reduction and distribution of duties.*—The Astronomical Observatory is furnished with a transit instrument and a sidereal clock, which are used for the determination of local time, primarily for communication to the shipping in the Bombay harbour, and secondarily for communication, by comparison of chronometers three times a week, to the Magnetical and Meteorological Observatory.

Magnetical and meteorological observations are taken and entered in the registration forms every day, without exception, at the hours 6, 10, 14, 16 and 22,—the day commencing at midnight at Bombay (Colába) and being reckoned from 0^h to 24^h. One observer (called the morning observer) takes the 6^h observation, a second one (the day observer) those of 10^h, 14^h and 16^h, a third one (the night observer) that of 22^h, and a fourth is relieved from observing duty for one week; the next week the four observers—including the computer who takes regular observing duty—change round in circular order, and so on week by week. On Sundays and general holidays special arrangements are made to set free all but three members of the staff—one being kept on observing duty, one in charge of photographic instruments, and one in charge of the Astronomical Observatory. All the observers reside on the premises, and they are required to keep a general out-look on the weather during the intervals between their respective hours of observing duty and the next earlier observation hours. Each observer reduces his own observation immediately after the entry of the observation in the register, and the reductions are checked by the observer who next comes on duty: amongst the duties of the day observer are included the calculation of daily averages, and the writing out of the monthly abstracts. These latter consist of tables having the days of the month marked in numerical order in the first column and the hours of the day in order at the head of the columns, and there is one for each magnetical or meteorological element observed. Attendance in the computing room is exacted of the observers, when not actually engaged upon observing duty, as well as of the First Assistant, Magnetical Department, Second Assistant, Astronomical Department, and Computer, for six hours daily, exclusive of a break for rest in the middle of the day. Upon the First Assistant devolves the immediate oversight of general observing, computing and photographic operations. The observations of absolute declination, horizontal intensity, and dip, which are repeated once, twice and four times respectively every week, are distributed amongst the more experienced observers in such a manner that no two consecutive weeks' observations shall, as a rule, fall to the same observer. The time of one Assistant is almost entirely absorbed by the photographic operations, the instruments requiring vigilant attention, and the chemical processes demanding much skill and care.

The anemograph is in charge of the Second Assistant, Astronomical Department, who changes the recording paper daily, and tabulates the hourly readings of direction and movement of the wind. The tabulations are checked by the Photographer, between whom and the Second Assistant, Astronomical Department, are divided also the resolution of the tabulations into components and the writing out and checking of wind abstracts, the one performing a set of operations and the other checking them, and so on alternately. The correspondence of the direction record to the actual direction of the vane is frequently checked by turning the instrument to point to the Kennery Lighthouse, the azimuth of which is accurately known. In order to preserve the direction gear in smooth working condition, the fixed toothed wheel is cleaned and oiled—without stopping the instrument—once a week; and every day the direction vane is turned right round the compass once each way, with the object of lubricating both sides of the teeth of the wheel.

All computing operations are systematically performed by one computer and checked, by a repetition of the operation, by another.

7. The eye-observations that are taken five times a day are subsidiary to continuous registrations obtained by means of automatic recording instruments. Of these there are five sets of apparatus,

I. The magnetographs,
II. The barograph,
III. The thermograph,
IV. The pluviograph, and
V. The anemograph,

of which IV is an appendage of III, designed to work with the same light and to trace its curve on the same sheet of sensitive paper. The first four register photographically and the last mechanically.

8. *Instruments and phenomena observed five times a day.*—These are as follows:—

Extent and description of clouds, state of the weather, occasional phenomena, and direction of the wind.	From 5 minutes before to 2 minutes after the exact hour.
Thermograph standard thermometer, dry bulb Do. do. wet bulb	At 2 minutes after the exact hour.
Newman's rain gauge (in wet season)...	„ 3 „ „
Thermometer in ground 1 inch deep... Do. do. 9 inches deep	From 5 to 7 „
Newman's standard barometer No. 58 and attached thermometer. Do. do. No. 48 ditto.	„ 7 to 9 „
Grubb's declination magnetometer	At 12 „ „
Grubb's horizontal force magnetometer and its thermometer	„ 14 „ „
Vertical force magnetograph, No. 2 and its thermometer	„ 16 „ „
Vertical force magnetograph and its thermometer...	„ 17 „ „
Declination magnetograph...	„ 18 „ „
Horizontal force magnetograph and its thermometer	„ 19 „ „
Thermometer attached to barograph ...	„ 20 „ „

The vacuum gauges of the magnetographs are read at 10 hours only, the maximum and minimum thermometers in the magnetograph room are read

and re-set at 10 hours only, and the 20 inches, 60 inches and 132 inches deep ground thermometers are read at 14 hours only.

Newman's rain gauge is read daily at midnight in the wet season, and the discharges of the syphon of the self-registering rain gauge are read once a day or oftener as required.

9. *Other routine operations.*—(1) The anemograph is supplied with fresh recording papers daily.

(2) Fresh sensitive papers are put upon the recording cylinders of the four magnetographs, of the barograph, and of the thermograph and pluviograph every two days. The papers taken off are developed, fixed and washed, and new ones are prepared by the photographer on alternate days.

(3) The tabulation of anemograms is effected as soon as the papers are available, generally, that is, on the day following that to which the record refers. Barograms, thermograms and declination, horizontal force and vertical force magnetograms also are regularly tabulated as soon as the registers are available.

(4) Double sets of observations of vibration and deflection are made with the unifilar magnetometer for the determination of the absolute horizontal force weekly, and with the same instrument observations of absolute declination are also made weekly.

Observations of magnetic dip are made four times a week.

The times of vibration of Grubb's declination and Grubb's horizontal force magnetometers are observed once a year; but each of the magnets is disturbed through a large arc (yet less than 1°) once a month, and the nearness of its return to the undisturbed position is recorded.

(5) Transit observations of stars for the determination of time are made generally on Mondays, Wednesdays and Fridays in the dry months: during the monsoon no opportunity is lost of observing the sun or stars when visible. The adjustment of the transit instrument is frequently tested by reference to the fixed collimator mark; the collimation, level, and azimuthal errors are determined from time to time, and whenever the collimator shows a displacement of the telescope, or any considerable discordances appear in the clock errors derived from observations of stars of different north polar distances.

Remarks on the Condition and Adjustments of the Instruments and on the Processes of Reduction.

10. The object of the following description is to make known such special circumstances in connection with the condition, situation and adjustment of the instruments, with the habits of the observers, and with the routine of the processes of reduction, as are necessary to enable the reader to form an independent judgment of the degree of precision attained, and of the weight to be attached to any conclusions that may be drawn from the observations.

I.—METEOROLOGICAL INSTRUMENTS, 1893.

Barometer.

11. *Description.*—The observations which furnished the fundamental data for the construction of the tables of barometric pressure for the year 1893 were taken with a standard barometer by Newman, marked No. 58, the same which has been used uninterruptedly since the establishment of the Observatory. The internal diameter of the barometer tube, marked by the maker on the frame of the

instrument, is 0·530 inch. The scale, which is of brass, is moveable, and terminates below in an ivory point which is designed to be set, at each observation, so as just to touch the surface of the mercury in the cistern, and the setting is known to be accurate when the point appears just to meet its image reflected from the mercury. The upper part of the scale, which is divided to twentieths of an inch, has a vernier with slow motion screw, reading to thousandths of an inch, and to it are attached two small brass plates with horizontal lower edges before and behind the tube: the setting of the instrument consists in raising and lowering the vernier until the horizontal plane containing these two edges is tangent to the surface of the mercury in the tube of the barometer, and this is the case when it is just so low, and no lower, that when the eye is raised or lowered no light is seen to pass between the central part of the mercurial surface and the two edges. A thermometer with a cylindrical bulb dipping into the mercury in the cistern is attached to the barometer, and is intended to be read at every observation; but an investigation described in the "Bombay Magnetical and Meteorological Observations, 1871-78," Introduction, pages xlii to xlv, showed that the errors of this thermometer—as measuring the temperature of the mercurial column—were considerable, and since the end of 1884 its use has been discontinued: in lieu of it a thermometer by Murray and Heath (No. 2) divided to half degrees, and with its bulb immersed in a column of mercury held in a glass tube of nearly the same diameter as that of the barometer, was fixed on one side of the metal frame of the barometer at about the same height as the middle of the barometric column, and this has been regularly observed since 1885·0. The error of the new thermometer varies by about a quarter of a degree within the annual range of the temperature of the barometer No. 58, and in adopting a mean error throughout small pressure corrections of ± ·0003 are disregarded.

The standard barometer is attached by means of brackets to a flat board which hangs against the wall on the eastern side of the Magnetical Observatory, near the north-east corner of the room, and its cistern has an elevation of 37 feet above the mean sea level at Colába. It was lifted down in May 1866 and the mercury carefully caused to run up to the top of the tube, where it gave the sharp metallic stroke that is indicative of a good vacuum. It is stated in the "Report of the Committee of Physics of the Royal Society, 1840," page 56, where a description is given of a class of barometers of which this is an individual, that the scale is laid off from the zero point from an authentic standard. The tube of the barometer is kept in proper adjustment to verticality.

12. *Error in setting the zero point of the scale, and change of method of observation.*—In the long period that has elapsed since the instrument was mounted (in 1841) there has been a gradual accumulation of scum on the surface of the mercury in the cistern, and the glass cistern became more and more opaque until the reflected image of the ivory zero point of the scale was very obscurely seen, so that the operation of setting the zero of the scale was uncertain to a very sensible degree. For this reason, the method of observation which had always previously been in accordance with the above description, was changed on the 22nd May 1866, so as to avoid the necessity of setting the scale at every observation. The scale was set once for all on that day and the setting screw then removed; and suitable corrections were thereafter applied for the rise and fall of the mercury in the cistern. These were taken from a table calculated by the formula*

$$\text{Capacity correction} = \cdot 04321\ (h_0 - 29\cdot 943)$$

where h_0 represents the uncorrected reading of the barometer. As the departure of the barometer reading from its mean value very rarely reaches 0·4 inch,

* The data for the construction of this formula will be found in the "Bombay Magnetical and Meteorological Observations, 1865–70," Introduction, pp. x, xi.

which would require a correction of only ·017 inch, it is very improbable that an error of so much as ·001 inch ever occurs from inaccuracy in the adopted value of the relative capacities of the tube and cistern. Since the change was made, the comparability of the observations for showing variations is, therefore, throughout much better secured.

13. *Corrections applied to the observed readings.*—It was stated in the instructions given in the Report of the Committee of Physics (page 56) that the correction for capillary action in barometers of this description is rendered inappreciable by the large diameter of the tube, and consequently no correction for capillarity has ever been applied. Besides the correction for capacity, two others only have been applied; one, invariably from the first, for reducing the observations to what they would have been if the temperature of the mercury had always been 32° Fahr. and that of the brass scale 62° Fahr., and the other, since 1885·0, to remove the discontinuity that would otherwise have been produced in the records by the change of thermometers: the first was taken from Table II. of the Committee's Report, and the last was a constant reduction of the corrected pressure by ·002 inch. The considerations on which the latter correction was based are as follows: (1) the tabulations of the barograph are known to exhibit correctly the diurnal variations of barometric pressure, free from any sensible influence of variations of the temperature of that instrument;* (2) the mean of twenty-four hourly barograph tabulations on any day is taken to correspond to the mean of the same twenty-four hourly pressures observed with Newman's barometer No. 58 and corrected for the temperatures indicated by the old attached thermometer; (3) it does not follow that the mean of the tabulations for the five observation hours (6, 10, 14, 16 and 22) will then correspond exactly to the mean of the observed pressures for the same hours, because the old thermometer does not indicate precisely the actual variations of temperature of the mercurial column: in fact the latter mean pressure was, on the average of all the observation days of the year 1872, ·0008 inch in excess of the former mean pressure; (4) nevertheless the correspondence for the five observation hours was adopted as near enough to identity with the correspondence for the twenty-four hours, and the recorded mean pressures of the years 1873 to 1884 will thus be ·0008 inch in excess of those of the years before 1873; (5) the old attached thermometer and the thermometer No. 2 by Murray and Heath were read together at the five observation hours throughout the year 1883, and the average excess of the former reading over the latter was found to be 0°·62; (6) hence to make the pressures reduced for the readings of Murray and Heath No. 2 correspond to those reduced for the readings of the old thermometer the former pressures must be decreased by $·0027 \times 0·62 = ·0017$, or—as the pressures are read and calculated only to thousandths of an inch—by ·002 inch. Thus taking the period before 1873·0 as a standard period, the recorded annual mean pressures of the years 1873 to 1884 will be ·0008 inch too high, and those of 1885 and later years ·0005 inch [$= -·0020 + ·0017 + ·0008$] too high.

14. *Comparison with the Kew Standard Barometer.*—Indirect comparisons of Newman's barometer No. 58 with the Kew standard have been made through the mediation of two mountain barometers by Negretti and Zambra, numbered 705 and 711: in Bombay these were both found (in July 1876) to read ·011 inch higher than Newman No. 58, whilst in England they had been found to be ·007 and ·006 inch respectively above the Kew standard: hence Newman's No. 58 reads on the average ·004 inch below the Kew standard. It happens that this is exactly the average amount by which the readings of Newman's barometer have been over-reduced for temperature (*see* Introduction to volume for 1871 to 1878, paragraph 72).

*See "Bombay Magnetical and Meteorological Observations, 1871-78," Introduction, pages xxxvii to xlvi.

Ground Thermometers.

15. Thermometers with their bulbs at the respective depths below the surface of the ground of 1, 9, 20, 60, and 132 inches are regularly observed, the two former five times a day and the three latter once a day at 14 hours. They are all by Newman, of London, and are divided on brass scales, and the value of one division, approximate range of part of scale exposed above ground, and lengths of that part and of one average degree are shown below for each thermometer:—

Depth of Bulb.	Divided to	Approximate Range of exposed part of Scale.	Length of that Range.	Average length of 1°.
Inch.			Inches.	Inch.
1	1°	30° to 145°	8·19	·071
9	0°·2	70° to 115°	5·20	·116
20	1°	35° to 160°	6·73	·054
60	1°	35° to 160°	6·81	·054
132	1°	50° to 140°	6·44	·072

The 1-inch and 9-inch thermometers are on flat brass scale frames, which lie against wooden posts in the ground, and they have their bulbs in contact with the loose red earth which fills the holes in which they are placed; the 20-inch, 60-inch, and 132-inch thermometers have their lower parts enclosed in brass tubes with ends curving off to a point, and the upper parts are in wooden box frames, to which the brass scales are fixed. The reason why only one observation is made daily of the three deeper thermometers is, that it had been found by hourly observations in 1849, 1850 and 1851, that no appreciable diurnal variation of temperature reached the depth of 20 inches.

The errors of graduation of the ground thermometers are unknown.

The Robinson-Beckley Anemograph.

16. *Description.*—From the beginning of the month of June 1867 was brought into use an anemograph of the kind designed by Robinson, with improvements by Robert Beckley, and it remains in action to this day. It was made by Mr. R. W. Munro, and was supplied through the Kew Committee of the British Association, after being tested at the Kew Observatory. In this instrument the arrangements for the registration both of movement and direction of the wind are mounted on one shaft, and the registrations are made on a single sheet of paper, which is changed daily. The essential part of the apparatus for measuring the movement is a vertical spindle, to which cross arms are attached at the top, carrying four hemispherical cups of copper. The cups are attached to their several arms, so that, looking from the central axis, their convex sides are seen turned to the right hand, and the wind, acting with greater effect upon the concave than on the convex sides of the cups, causes the system to rotate in a right-handed direction. It is the number of these rotations, 140 of which are reckoned to a mile of movement of the wind, that tells us how fast the wind has been blowing; and the number is reduced, by means of wheelwork, 7,000 times before reaching a small cylinder, carrying a brass spiral pencil that traces the movement on the registering paper; this latter is metallic paper of the kind used for pocket-books, and is wrapped round a brass cylinder, which is kept rotating by clockwork, and as the paper passes under the spiral pencil, which presses slightly upon it, the black movement trace is received upon it. The wind vane, which consists of a pair of windmill vanes with connecting spindle having an endless screw in the middle, and gearing into a fixed horizontal toothed wheel, is attached to a tube that surrounds the lower part of the vertical movement spindle; to the bottom of the tube is fixed a toothed wheel, which, in communication with other such wheels, conveys the motion of the vane *unchanged* to a small cylinder with spiral pencil, which traces the changes of direction on the register;

and it is so arranged that the movement and direction are traced on parallel strips or bands of the same sheet of paper. The heavy parts of the instrument—the direction vane and appendages, and two long brass tubes which connect the instrument proper with the recording apparatus—are supported on friction balls which run in grooves partially filled with oil, thus reducing the friction to a minimum. The instrument is erected on the old Time Ball Tower, at a height of 53 feet above the ground, and 95 feet above the mean sea level, over a platform 12 feet in diameter, which is designed to give ready access to the instrument, and to protect it from irregular currents of wind, glancing from the convex surface of the dome; and it is supported outside by a fixed cast-iron standard, to which is attached, at the top, the toothed wheel, into which the endless screw of the spindle connecting the windmill vanes gears. The centres of each pair of opposite hemispherical cups are four feet apart, and three and a half feet above the platform, and the diameter of the cups is nine inches. The diameter of the vanes is 15 inches, and the breadth of the fans four inches. The register form is printed in red, with lines dividing its length into hour spaces; and its breadth, on the movement side, into five spaces, each representing 10 miles of movement of the wind, and numbered from 0 to 50 miles; and on the direction side into spaces corresponding to 11¼ degrees on each side of the 16 principal directions N.N.E., N.E., &c.....N.N.W., N., which spaces are numbered consecutively 1, 2, &c..... .15, 16.*

17. *Tabulation of Anemograms.*—Numerical tabulations have been made of the movement and direction of the wind during the interval between every two successive hours in the following manner:—the number of miles indicated at the point where the velocity trace cuts a horizontal hour-line being read for two successive hours, the excess of the latter over the former reading (adding 50 if the trace has passed over from left to right of the form) gives the movement for the interval; and the number of the space in which the direction trace lies during the interval is entered as representing the direction. The estimations of movement are made only to the nearest full mile. Should the direction trace not lie all in one space during the whole interval of an hour, then if the change of direction exceed 90° or eight points, the whole observation for that hourly interval is rejected; but if it lie within that limit, the direction is estimated—by an inspection of the movement and direction traces together—whence the aggregate flow of air was the greatest, and this direction is adopted for the full hour. On the average of the years 1871 to 1883, out of 8,754 hours during which the instrument was in action, 3 only had to be rejected because the direction of the wind varied more than eight points within the hour.

18. *Method of reduction.*—Hitherto we have had to speak of phenomena liable only to simple increase and decrease of value, and not subject to any change of quality. Such phenomena being properly and completely evaluated by simple numbers, we may apply to the numbers any arithmetical operations, such as averaging, and infer from the results of those operations corresponding properties of the phenomena. But we have now come to a phenomenon which requires two numbers to express it, one representing its amount and the other a varying quality; the first referring to the velocity, and the last to the direction of the wind. Here we may no longer apply arithmetical processes directly and indiscriminately to the observed numbers: but, the subject being one of motion, we must treat them according to the principles of the science of motion. These principles tell us that the motions may be equally well expressed by means of two varying numbers referring to two invariable qualities, as by a varying number referring to a varying quality; and they show us how to obtain either form of expression from the other. The invariable qualities chosen in the present case are the directions north and east, the actual wind blowing in

* A more detailed account of the Colába anemograph will be found in the "Bombay Magnetical and Meteorological Observations, 1865 to 1870," Appendix I., page 199.

each hour being resolved into north and east components, which may be regarded separately as the velocity of the wind in the invariable direction north or south, and the velocity of the wind in the invariable direction east or west. The resolutions are effected by means of the formulæ :—

$$\text{North component of velocity of wind} = m \cos (n \times 22\tfrac{1}{2}^\circ),$$
$$\text{East component of velocity of wind} = m \sin (n \times 22\tfrac{1}{2}^\circ),$$

where m is the movement observed, and n the number of the direction space under which the wind of the hourly interval is classed. When the sign of either of these calculated quantities is negative, it implies that the wind blows from the opposite direction, *i. e.* from south or west. The calculations are readily made by means of tables to the nearest tenth of a mile of velocity per hour. Having now substituted the two equivalent winds for the real one, we may with propriety proceed to combine together numbers of observations by algebraical addition and averaging, treating the north and east components of the wind each by themselves. The averages thus found from the observations of any given period will represent the velocity with which the wind must blow from the northward (from the southward if the sign of the average be negative) continuously for the whole period, in order that the total movement of the wind from that direction may be the same as the total movement from the same direction produced by the winds which actually blow, and similarly the velocity with which it must blow continuously from the eastward (westward if the sign of the average be negative).

No corrections have been applied to the anemograph tabulations on account of friction.

Rain Gauge.

19. *Newman's Rain Gauge.*—This instrument is made of copper, and exposes for the collection of rain-drops a circular surface of an average diameter of 12·035 inches, forming the top of a funnel, that carries the rain into a cylindrical vessel below, having a diameter of 5·732 inches: a float of slightly less diameter, so as to rise and fall freely, rests upon the water in this vessel, and having a wholly convex external surface, it allows the rain as it falls to flow off and raise the level of the water and with it the float; to the middle of the float is fixed a wooden rod, graduated with divisions, each of which represents ·05 inch of rain; and the readings of this scale, which are easily estimated to fifths of a division, are made where it is cut by the upper edge of a light brass rod placed horizontally across the mouth of the funnel, but half an inch below the edge of the exposed circular surface; the scale passes through a hole in the middle of the horizontal rod, and is thus kept always in a vertical position. The range of the scale is from 0 to 4·00 inches, and the readings of the scale have been entered in the meteorological register and the differences been taken for every interval between successive observations: the rain has accumulated in the vessel generally till the reading was somewhere above 2·00 inches, when the water was let out, by means of a brass cock at the bottom, till the reading came down to 0·00 inch. This latter reading was also maintained during intervals of dry weather—when, from evaporation, the scale would otherwise have fallen lower—by pouring small quantities of water into the gauge: the reason of this is obvious, as, if some water were not always retained, the float would sometimes rest on the bottom of the vessel and so cease to perform its function of rising equally for equal increments of rain. The scale on the wooden rod was graduated so as to agree approximately with the data—the diameters of the gauge and measuring vessel—given above. The error of the scale according to which the rod was graduated was less than a thousandth of the whole.

Newman's gauge stands on a large rectangular block of stone, in a position intermediate between the Entrance Gate, the Magnetical Observatory, and the

Thermograph Shed, where the altitude of the highest neighbouring object, as seen from the gauge, is about 30°. It is supported by three feet, which are embedded with lead in holes cut in the stone block, and its circular mouth is at a height of 4½ feet above the ground and about 35 feet above the mean sea level.

Barograph and Thermograph.

20. Like the anemograph, the Colába barograph and thermograph were supplied through the Kew Committee of the British Association, after being tested at the Kew Observatory; and they are of like construction with those adopted by the Meteorological Committee of the Royal Society for the seven observatories established by them in the year 1867 in the United Kingdom. An account of these instruments in general, with notes on the peculiarities of the Colába set and on special points in the Colába arrangement of them and utilization of their registrations, will be found in the 1871—78 volume of this series. Introduction, pages xvi to xlvi.

21. *Thermograph.*—The height of the bulbs of the thermometers above the ground is 10 feet. The cage is placed on one of the most exposed parts of the Observatory grounds and away from any building: it is, however, screened, as well as the thermograph room in which the recording apparatus is placed, by a roomy shed with a planked roof that is everywhere 2 feet above the roofs of the cage and room: the sides of the shed are of the louvre construction on an enlarged scale, with double sheets of zinc enclosing a thick layer of felt substituted for the wooden laths, and with a vertical distance from lath to lath of one foot: the lowermost two feet of the sides are guarded simply by horizontal iron rods: the roof of the shed is covered with thick felt and then with strong canvas, and the whole of the exterior—sides and roof—is painted or limewashed white.

Pressure of Vapour.

22. *Pressure of Vapour and additional capacity of the Air.*—Having obtained from the tabulations of the barograms and thermograms hourly values of barometric pressure, temperature of the air, and temperature of evaporation, the pressure of vapour was calculated for each hour with the aid of a table by the formula

$$f''=f'-\cdot01147\,(t-t')\times\frac{P-f'}{30}$$

in which t and t' denote the temperatures of the air and wet bulb thermometers respectively, f'' and f' the pressure of vapour at the temperature of the dew point and at temperature t', and P the barometric pressure. The values of the pressure of vapour at different temperatures were taken from the following table, the numbers in which have been extracted from Boileau's Collection of Tables:—

Table I.—*Regnault's values of the Pressure of Vapour at different Temperatures.*

Temperature.	Pressure of vapour.	Temperature.	Pressure of vapour.	Temperature.	Pressure of vapour.	Temperature.	Pressure of vapour.	Temperature.	Pressure of vapour.	Temperature.	Pressure of vapour.	Temperature.	Pressure of vapour.	Temperature.	Pressure of vapour.
°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.
35	·204	43	·278	51	·374	59	·500	67	·662	75	·868	83	1·128	91	1·455
36	·212	44	·288	52	·388	60	·518	68	·685	76	·897	84	1·165	92	1·501
37	·220	45	·299	53	·403	61	·537	69	·709	77	·927	85	1·203	93	1·548
38	·229	46	·311	54	·418	62	·556	70	·733	78	·958	86	1·242	94	1·597
39	·238	47	·323	55	·433	63	·576	71	·758	79	·990	87	1·282	95	1·647
40	·248	48	·335	56	·449	64	·596	72	·784	80	1·023	88	1·324	96	1·698
41	·257	49	·348	57	·466	65	·617	73	·811	81	1·057	89	1·366	97	1·751
42	·267	50	·361	58	·482	66	·639	74	·839	82	1·092	90	1·410	98	1·805

To find the additional capacity of the air the pressure of vapour was deducted from the number in the above table standing opposite to the temperature of the air.

Self-registering Rain Gauge.

23. A description of this instrument also will be found in the Introduction to the "Bombay Magnetical and Meteorological Observations, 1871 to 1878," page xlvi. In 1893 the syphon discharges were received in glass bottles and measured by means of a graduated glass tube and a marked glass bottle holding exactly half an inch of rain.

24. It was mentioned in former years that the occurrence of the discharging action of the syphon was occasionally liable to some uncertainty—the water at times trickling over the bend of the tube in considerable quantities before the proper discharge commenced. After trial of many modifications in the form of the syphon one was at last hit upon, which is free from this fault, and by which the tube is, moreover, kept in a satisfactorily clean condition from beginning to end of the monsoon, simply by the washing that takes place in the ordinary automatic discharges. Since November 1884, when the new syphon was brought into use, the discharges have been regular and unfailing except on two occasions, *viz.*, on the 18th June and 5th November 1890 when trickling again occurred: this was traced, in the last case, to the presence near the bend of the syphon tube of a living cockroach: To prevent this from occurring again, a lid of zinc was fitted to the discharge pipe at its entry into the receiving bottle, so as to cover the mouth of the bottle.

25. To prevent birds alighting upon the funnel, and choking it with their droppings, a conical arrangement of pointed iron spikes surrounding the funnel was attached in 1882, and was found to be effective.

26. *Constants for converting syphon discharges into inches of rainfall.*—As the surface exposed by the rain gauge funnel is 50·286 square inches, an inch of rain contains 823·955 cubic centimeters. With the aid of a cubic centimeter measure,* 412 cubic centimeters of water were poured into a narrow-necked glass bottle, and a file mark was made on the bottle neck at the level up to which the water rose. A glass tube was also graduated by means of the same cubic centimeter measure, so as to read off thousandths of an inch of rain with ease. The bottle is filled as often as there have been discharges from the rain gauge syphon, and the final excess or defect is measured with the graduated tube. The use of the bottle began on 31st July 1879 and continued till the 26th July 1884, when it was accidentally broken. An exact copy of it, which had been prepared beforehand, was then substituted for the original bottle, and this copy is still in use.

27. *Measurement and distribution of syphon discharges.*—The discharges are measured daily, or oftener during heavy rainfall, and are of course always of an integral number. For each measurement the average value of a discharge is attributed to each of the intervals of time, shown on the rain curve, between pairs of successive discharges; and it remains then only to distribute this quantity, for each filling of the receiving vessel, by means of tabulations of the ordinates of the rain curve. When, as is often the case, the rate of fall of the rain at the time of a discharge exceeds 1½ inch per hour, it is necessary to allow for the rain that enters the receiving vessel during the known time (16 seconds) of discharge, the allowance depending on the rate of rainfall, which is easily estimated for this purpose by noting, with the aid of an appro-

* Lent by Mr. F. Chambers, whose verification data show it to be accurate to a thousandth of the 100 cubic centimeters which it is designed to measure.

priate paper scale, the inclination of the rain curve immediately after the time of discharge. The aggregate of such allowances is deducted from a day's (or other) measurement before dividing the quantity equally amongst the several intervals.

28. *Determination of scale of rainfall ordinates.*—The factor for converting ordinates of the rainfall curve into inches of rainfall was found by experiments in which a determined weight or volume of distilled water was poured into the receiving vessel, and the change of length of the ordinate produced thereby was carefully measured. In an experiment made on the 5th June, 1893, the quantity of water poured into the vessel was equivalent to ·480 inch of rain, and the change of length of the ordinate ·480 of a true inch; whence the factor is found to be 1·000, which is applicable to all the rainfall registrations of the year 1893.

29. The tabulations are made with the true-inch scale of the thermograph tabulating instrument, using the white line as datum; and the reading of this datum that shall correspond to the reading ·000 of the rain curve, when the receiving vessel has just been discharged, is re-determined whenever the adjustment of the recording apparatus is disturbed. For this purpose an average is taken of a number of measurements for all of which the rain is falling very slowly at the time of the syphon's coming into action and for a short time longer. It is necessary to select such occasions, because at times of heavy rainfall the curve has risen sensibly before the light has had time to make a distinct impression on the sensitive paper. The mode of tabulating is (1) to set the scale on the constant reading corresponding to the white line, (2) to move the sliding piece until the index is set upon the white line, and (3) to move the sliding bar till the index is set upon the curve, and then read the scale. By setting the paper carefully, so that a considerable length of the white line is practically parallel to the lateral motion of the frame, the repetition of the first two operations of tabulation is avoided until many hourly ordinates have been read; and then a new setting of the paper is made for another stretch of the white line.

Description of the Tables of Meteorological Results and of the Processes of Reduction, 1893.

30. *Barometric Pressure.*—In Table I is shown, for every day in the year, the mean of 24 hourly tabulations of the barograph, corrected* to agree with Newman's barometer No. 58;—also the mean pressure for each month and each year, and the excess of each monthly mean above the annual mean for the same year; and the principal features of the annual variation are indicated at the foot of the table. The maximum and minimum daily pressures in each month are distinguished by being printed in strong figures.

31. *Temperature of the Air, &c.*—The plan of the following tables is the same as that of Table I, but the subjects of them and the sources from which the numbers are obtained and the mode of obtaining them are as stated below:—

Table II.—Temperature of the air: derived from hourly tabulations of the thermograph dry-bulb.

Table III.—Pressure of vapour: derived from hourly tabulations of the thermograph dry-bulb and wet-bulb; and of the barograph; and calculated in the manner described in paragraph 22.

Table IV.—Additional capacity of the air: derived from hourly differences between the pressure of vapour corresponding to the temperature of the air and the calculated actual pressure of vapour.

* In the manner described in paragraph 54 of the Introduction of the "Bombay Magnetical and Meteorological Observations for 1871 to 1878."

Table VII.—Velocities of the north and east components of the wind: derived from hourly tabulations from the register of the Robinson-Beckley anemograph.

Table VIII.—Velocity of the wind regardless of direction: derived from hourly tabulations from the register of the Robinson-Beckley anemograph.

Table XI.—Extent of cloudy sky: derived from estimations made at the hours 6, 10, 14, 16 and 22 daily.

32. Tables VI and XII are on the same plan as Table I, except that the entries made in them are aggregates—daily, monthly and yearly—instead of mean values; and they are sufficiently explained by their several headings.

33. *Monthly and annual range of variation of Meteorological Elements.*—Table V shows the extreme limits between which the oscillations of barometric pressure, temperature of the air, pressure of vapour, and additional capacity of the air were confined in each month and in the whole year, and also the ranges of the respective oscillations.

34. The numbers in Table IX are derived from hourly tabulations from the register of the Robinson-Beckley anemograph. The temperatures of the ground given in Table X are derived from the readings of the several thermometers, made five times a day as regards the 1 inch and 9 inches deep thermometers, and once a day as regards the 20 inches, 60 inches and 132 inches deep thermometers. The five-day means of Table XIII are derived from hourly tabulations of the barograph (combined with readings of Newman's barometer No. 58) and thermograph, from the measurements in Newman's rain-gauge, and from hourly tabulations from the register of the Robinson-Beckley anemograph. In other respects these tables require no explanation beyond their titles, the headings of the several columns, and the foot notes.

Notes on instrumental changes and on all irregularities or departures from the routine of observation or reduction in 1893.

35. *Robinson-Beckley Anemograph.*—External parts painted on May 20 and December 23. Instrument partially dismounted and cleaned on September 28. The aggregate of all the interruptions of the instrument in the year 1893 was $2^h\ 26^m$: the loss of record was, however, rarely complete, and values partly or entirely interpolated have been inserted whenever the interruption was not somewhat prolonged. To aid in the making of interpolations, it has been customary, whenever the action of the instrument was voluntarily interrupted for more than one hour, to observe the direction of the wind by estimation, and to record the readings of a small auxiliary velocity measurer put up for the occasion. No complete day's records have been omitted in the formation of monthly abstracts.

36. When for any reason the traces furnished by the photographic self-registering instruments are interrupted, and the interruption includes the moments when one or more hourly tabulations should be made, these last are either substituted by the corresponding eye-observations, if the hours should happen to be any of the five regular observation hours, or if special eye-observations were taken for the purpose, or else, if no eye-observations are available, they are interpolated. In the last case, if the interruption lasts for less time than one hour, the interpolation is made on the assumption that the rate of change of the phenomenon from its value at the beginning to its value at the end of the interruption was uniform, providing that the parts of the curve immediately preceding and immediately following the gap were, in appearance, continuations of the straight line connecting the extremities of the gap. If the last condition is not satisfied, or if the gap, taking account of points inserted by means

of eye-observations, is of greater length than one hour, the interpolation is made between the next preceding and the next following hourly entries, first, by allowing for the known *normal* rate of change of the phenomenon between those hours in the same month, and then by assuming that any additional change, shown by the difference between the values of the phenomenon at the two extreme hours, has grown at a uniform rate. Interpolated values are entered in the abstract sheets with enclosing square brackets—inserted eye-observations between parentheses.

37. *Barograph.*—No tabulations were obtained for the following hours for the several reasons stated, but an eye-observation was available and was adopted for the hour marked within parentheses, and for the rest interpolation had to be resorted to:—

(1) Slit for the admission of light was disturbed by the stop marking the watchman's attendance, and the curve was thereby made to overlap slightly: for 1893 February 18^{d} 7^{h}.

(2) Recording cylinder pushed in same way through the back lash of its driving wheel and curve thereby made to overlap slightly: for 1893 November 20^{d} (22^{h}).

Occasional, though rare, failure of the bihourly stops to act has caused no loss of record.

The aggregate of all the interruptions of the barograph in the year 1893 was 1^{h} 23^{m}*, and the number of hourly tabulations lost was 2, but of these 1 was substituted by an eye-observation, leaving only 1 to be interpolated.

38. *Thermograph dry-bulb.*—No tabulation was obtained for 21^{h} of the 6th May 1893 on account of a stoppage of the clock.

Occasional, though rare, failure of the bihourly stops to act has caused no loss of record.

The aggregate of all the interruptions of the thermograph dry-bulb in the year 1893 was 1^{h} 36^{m}; only one hourly tabulation was lost, and the place of it was supplied by an interpolated value.

39. *Thermograph wet-bulb.*—No tabulations were obtained for 21^{h} of the 6th May 1893 on account of a stoppage of the clock nor for 14^{h} to 17^{h} of the 1st November 1893 on account of drying of the muslin covering of the bulb and imperfect capillary action of the threads.

Occasional, though rare, failure of the bihourly stops to act has caused no loss of record.

The aggregate of all the interruptions of the thermograph wet-bulb in the year 1893 was 14^{h} 4^{m}, made up chiefly of short intervals of time occupied in cleaning and renewing the muslin coverings of the bulbs and the bundles of threads connecting them with the supply of water. The number of hourly tabulations lost was 5, all of which had to be interpolated.

40. *Self-registering Rain-gauge.*—Copper tube which connects the funnel with the receiving vessel was choked with the droppings of crows, and part of the twenty-five hours' rain that fell from 1893 May 28^{d} 19^{h} to 29^{d} 20^{h} escaped without registration. The iron spikes referred to in paragraph 25 were sharpened, and have since been effective in preventing these occurrences.

II.—MAGNETICAL INSTRUMENTS, 1893.

Kew Absolute Declinometer and Deflection and Vibration Apparatus.

41. A description of this instrument, with which the observations of absolute declination and of horizontal intensity for the year 1893 have been

* If not unusually prolonged, the short interruptions caused by the regular changing of photographic papers and by changing of lamps are not included in the above aggregate, nor in the aggregates of interruptions of the thermograph that follow further on.

taken, will be found on pages xxxiii to liii of the Introduction to the "Bombay Magnetical and Meteorological Observations, 1865—70"; the description includes also an account of the situation of the instrument, of the nature and routine of the observations taken with it—with examples of observation and computation forms filled up with the figures of actual observations—and of the formulæ of reduction and the constants involved in them.

42. The entries in columns 1 to 17 and 19 of the Tables of Observations of Absolute Horizontal Force are copied directly from the computation form: column 18 is given to show the degree of accordance existing in the determinations from deflections with the deflecting magnet at the respective distances 0·8 foot and 1·0 foot from the deflected magnet; and the numbers in column 21 are the products of those in column 20 multiplied by the constant number ·46108.

43. The description, referred to above, of the observation of absolute declination will render clear the meaning of the numbers entered in each column of the Tables of Observations of Absolute Declination: all of these, except the monthly means in columns 12 and 13, are taken directly from the observation form.

Kew Dip Circle.

44. A description of this instrument, and of the mode of using it, is also given in the Introduction to the "Bombay Magnetical and Meteorological Observations, 1865—70," pages lvi to lix, and the following additional or corrective remarks will make it applicable to the observations of 1893:—

(1) The place of observation has been the top room of the Electrometer Tower, the dip circle having been placed on the same pillar on which the Kew unifilar magnetometer is placed in the regular observations of absolute horizontal force and absolute declination. The reading of the azimuth circle adopted for this place has invariably been 63° 31′. An observation for the verification of this reading was made on the 22nd February 1881.

(2) The dip needles used during the year 1893 have been as follows:—
For the regular observations:—
Dover, Charlton No. 1.
" " No. 2.
And for supplementary observations:—
John Dover No. $\frac{1}{81}$.
" " No. $\frac{2}{81}$.

(3) The final cleaning of the axles of the needles has throughout been made with a clean silk cloth.

CHARLES CHAMBERS,
Director.

Colába Observatory, May 1894.

TABLES OF RESULTS

DERIVED

FROM THE CONTINUOUS REGISTRATIONS OF AUTOMATIC METEOROLOGICAL INSTRUMENTS

AND FROM

METEOROLOGICAL OBSERVATIONS,

1893.

TABLES OF RESULTS

DERIVED FROM THE

METEOROLOGICAL OBSERVATIONS MADE DAILY AT 6, 10, 14, 16 AND 22 HOURS,

1893.

FIVE-DAY MEANS,

1893.

B 251—1 E

TABLE I.—Barometric Pressure, 1893.

Height of Barometer above mean Sea-level = 37 feet.

1893. Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
1	29·968	29·942	**29·955**	**29·891**	29·730	29·715	29·693	29·717	29·739	29·850	29·925	29·976
2	·933	·958	·945	·859	·747	·719	·742	·714	·708	·782	·945	·980
3	·935	·933	·944	·872	·796	·739	**·770**	·687	**·691**	·747	·946	·929
4	·945	**·894**	·921	·840	·809	**·749**	·710	·660	·721	·772	·928	·924
5	·920	·935	·920	·837	·804	·709	·648	·647	·754	·788	·945	·966
6	·916	·967	·951	·854	·813	·689	**·631**	·647	·776	·778	·914	·984
7	·914	·958	·945	·824	·783	·660	·632	·629	·785	·757	·855	·962
8	·923	·948	·918	·847	·820	·657	·665	**·618**	·759	·754	·826	·971
9	·937	·941	·944	·877	**·846**	·685	·714	·690	·706	·769	·851	30·003
10	·927	·923	·925	·891	·835	·667	·702	·748	·697	·750	·878	·005
11	·895	·942	·918	·867	·797	·622	·699	·738	·701	·727	·892	·001
12	**·839**	·910	·895	·837	·796	·615	·705	·768	·715	·726	·861	**·014**
13	·841	·925	·848	·813	·816	·633	·703	**·809**	·770	**·708**	·847	·002
14	·861	·931	·826	·785	·796	·643	·659	·792	·805	·730	**·819**	29·973
15	·840	·952	·809	·756	·778	·601	·655	·782	·824	·755	·841	30·001
16	·850	·976	·825	·779	·756	**·518**	·670	·780	·823	·737	·902	·004
17	·883	·919	·822	·704	·786	·520	·660	·770	·833	·784	·916	·001
18	·876	·932	·818	**·686**	·808	·592	·666	·765	·812	·834	·904	29·977
19	·887	·941	·796	·755	·819	·604	·669	·776	·810	·854	·856	30·000
20	·906	·920	·779	·746	·792	·587	·692	·745	·804	·885	·850	·002
21	·896	·916	·794	·748	·766	·612	·703	·757	·791	·907	·900	29·968
22	·894	·911	·809	·747	·719	·646	·694	·770	·775	·932	·932	·964
23	·866	·923	·796	·752	·725	·663	·676	·738	·776	**·959**	·923	·937
24	·876	·962	**·772**	·793	·741	·638	·642	·700	·758	·934	·901	·897
25	·899	**30·006**	·777	·767	·708	·656	·640	·703	·779	·910	·923	·896
26	·924	29·945	·817	·713	·658	·676	·667	·749	**·843**	·912	·940	·919
27	·913	·917	·866	·694	**·606**	·657	·722	·766	·838	·905	·958	·909
28	·954	·948	·906	·716	·610	·628	·746	·734	·799	·902	**·966**	·897
29	**·976**		·887	·739	·612	·653	·741	·728	·810	·904	·919	·910
30	·968		·855	·751	·626	·695	·695	·721	·840	·935	·912	·888
31	·953		·862		·700		·684	·724		·928		**·846**
Monthly Mean.	29·907	29·938	29·866	29·791	29·755	**29·648**	29·687	29·728	29·775	29·826	29·899	**29·958**
Annual Variation ...	+·092	+·123	+·051	—·024	—·060	—·167	—·128	—·087	—·040	+·011	+·084	+·143

	in.
Annual mean	29·815
The greatest mean daily barometric pressure in the year (that of 12th December) was	30·014
The least do. do. do. (that of 16th June) was	29·518
Difference =	0·496

TABLE II.—Temperature of the Air, 1893.

1893. Date.	MONTH. January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	°	°	°	°	°	°	°	°	°	°	°	°
1	75·7	71·5	**73·1**	**79·2**	82·7	83·8	80·0	80·8	80·0	81·1	79·3	80·1
2	75·4	70·9	74·0	80·6	82·9	83·8	79·3	80·9	79·1	81·0	79·7	**80·7**
3	72·9	71·2	75·3	80·4	82·8	83·9	79·3	79·5	80·9	81·0	79·7	79·5
4	72·5	72·8	76·2	81·5	83·0	84·1	79·8	79·0	79·8	79·5	79·9	78·3
5	74·5	72·3	76·9	82·5	83·0	84·6	78·8	80·2	79·2	80·0	79·3	79·1
6	74·5	72·6	75·5	81·5	83·5	84·8	78·7	78·6	78·7	80·6	78·5	78·2
7	70·2	70·4	74·5	82·0	84·0	84·9	80·4	78·8	78·6	80·6	79·3	77·6
8	74·7	**68·1**	76·1	81·2	84·3	83·3	81·6	78·3	78·6	81·3	78·6	76·6
9	**77·3**	71·4	76·5	80·0	84·3	**85·8**	80·5	79·7	80·2	81·8	79·1	77·4
10	76·1	71·6	76·7	80·5	83·7	82·3	81·5	80·4	80·2	82·0	79·2	77·5
11	75·9	70·9	76·4	82·2	84·3	82·9	81·8	79·8	80·6	81·8	78·8	77·6
12	73·5	71·6	77·1	84·7	84·3	81·7	81·9	80·4	80·6	81·4	79·1	77·3
13	73·2	72·4	79·1	83·6	84·1	80·8	**82·0**	80·6	80·9	**82·6**	81·3	75·7
14	73·7	73·7	80·5	83·2	83·8	80·9	81·8	80·3	80·1	82·4	**82·2**	75·0
15	73·5	72·2	**81·3**	83·9	83·3	80·4	81·9	79·2	79·8	82·0	81·0	74·9
16	73·0	73·6	80·3	**86·0**	83·2	79·3	81·0	**77·1**	79·9	82·0	80·4	76·3
17	71·9	72·3	79·6	84·7	83·1	78·5	81·5	80·0	78·6	80·4	79·5	76·3
18	71·0	71·2	78·2	84·1	83·6	79·6	81·7	80·5	79·7	79·2	78·2	75·9
19	70·2	71·1	77·1	84·3	83·7	79·4	80·3	81·2	79·4	**78·1**	79·2	76·6
20	69·8	71·2	76·4	83·5	83·8	**77·4**	80·3	81·3	79·8	78·9	79·8	75·3
21	69·9	72·1	75·8	81·6	83·8	78·8	**78·1**	**81·4**	79·9	79·9	77·2	75·3
22	72·8	72·8	76·5	82·1	84·2	78·5	80·8	80·2	79·3	78·4	76·4	75·0
23	72·6	74·9	77·0	82·7	84·5	81·4	80·7	80·9	**78·2**	78·9	**76·2**	74·9
24	73·0	**75·4**	78·2	83·3	85·0	81·1	81·2	80·4	79·9	79·2	77·1	74·6
25	72·8	72·7	78·1	83·1	85·3	82·0	81·4	80·8	79·7	79·5	79·3	73·8
26	73·4	71·5	78·2	83·6	**85·5**	81·8	81·1	81·0	79·3	78·5	78·9	**73·4**
27	73·8	73·2	78·3	83·6	85·3	82·1	80·6	80·3	80·1	78·3	79·4	74·4
28	73·1	73·7	77·7	83·8	82·0	81·8	78·6	78·6	80·6	78·6	80·0	75·6
29	71·9		77·2	83·4	**79·8**	82·4	80·7	79·6	80·1	78·8	79·9	76·1
30	70·2		78·7	83·0	80·4	81·1	78·2	79·3	**81·1**	78·9	80·4	75·8
31	**69·3**		79·4		84·0		80·3	80·4		79·8		76·2
Monthly Mean.	72·9	**72·1**	77·3	82·7	**83·6**	81·8	80·5	80·0	79·8	80·2	79·2	76·5
Annual Variation ...	—6·0	—6·8	—1·6	+3·8	+4·7	+2·9	+1·6	+1·1	+0·9	+1·3	+0·3	−2·4

	°
Annual mean	78·9
The greatest mean daily temperature of the air in the year (that of 16th April) was	86·0
The least do. do. do. (that of 8th February) was	68·1
Difference =	17·9

Table III.—Pressure of Vapour, 1893.

1893. Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
1	0·660	0·487	0·607	0·779	0·786	0·867	0·872	0·866	0·859	0·864	0·689	**0·794**
2	**·694**	·487	·639	·782	**·783**	**·844**	·874	·861	·847	·850	·659	·794
3	·572	·472	·682	·799	·812	·848	·870	·863	·851	·834	·619	·702
4	·525	·559	·701	·775	·855	·847	·884	·863	·850	·791	·626	·621
5	·606	·596	·720	·759	·895	·870	·871	**·890**	**·875**	·828	·574	·643
6	·567	·639	·653	·808	·868	·924	·882	·868	·837	·884	**·558**	·618
7	·505	·459	·626	·766	·860	·889	·897	·866	·852	·893	·642	·631
8	·612	**·373**	·674	·849	·852	·917	·909	·865	·838	·939	·725	·638
9	·647	·403	·695	·797	·861	**·970**	·886	·883	·845	·939	·740	·651
10	·632	·515	·711	·831	·864	·912	**·912**	·866	·831	·921	·736	·682
11	·554	·515	·679	**·867**	·879	·929	·899	·858	·836	·920	·767	·622
12	·555	·504	·715	·852	·865	·914	·887	·865	·850	·875	·772	·588
13	·540	·616	·745	·865	·848	·904	·880	·867	·850	·919	·810	·557
14	·569	·644	·704	·807	·884	·918	·875	·850	·857	**·946**	·769	·555
15	·575	·565	·603	·804	·864	·905	·885	·837	·851	·862	·785	·534
16	·594	·606	·675	**·722**	·863	·888	·876	·829	·858	·708	·840	**·516**
17	·518	·563	·764	·797	·867	·891	·897	·844	·841	·690	**·852**	·528
18	·463	·466	·758	·743	·870	·911	·890	·844	·845	·752	·818	·570
19	·430	·449	·662	·756	·849	·886	·875	·835	·839	·693	·809	·547
20	**·427**	·497	**·592**	·767	·832	·866	·885	·839	·830	**·649**	·835	·576
21	·499	·581	·597	·795	·817	·893	·869	·856	·820	·693	·808	·572
22	·509	·652	·612	·827	·874	·889	·896	**·828**	·827	·719	·749	·589
23	·568	**·729**	·610	·834	·897	·918	·874	·833	**·807**	·707	·724	·581
24	·625	·698	·624	·856	·907	·901	·867	·839	·828	·721	·794	·590
25	·614	·557	·705	·853	·889	·925	·861	·853	·838	·707	·801	·599
26	·630	·522	·707	·866	·919	·920	·863	·850	·828	·731	·770	·637
27	·591	·589	·707	·850	·931	·927	·846	·842	·812	·758	·785	·644
28	·642	·593	·728	·799	·926	·906	·837	·851	·810	·751	·792	·608
29	·568		·732	·805	·912	·909	·848	·864	·818	·762	·782	·652
30	·433		·770	·796	·931	·883	**·816**	·873	·837	·732	·793	·707
31	·434		**·800**		**·942**		·856	·863		·722		·687
Monthly Mean	0·560	**0·548**	0·684	0·807	0·871	**0·899**	0·875	0·855	0·839	0·799	0·748	0·620
Annual Variation	—·199	—·211	—·075	+·048	+·112	+·140	+·116	+·096	+·080	+·040	—·011	—·139

	in.
Annual mean	0·759
The greatest mean daily pressure of vapour in the year (that of 9th June) was	0·970
The least do. do. do. (that of 8th February) was	0·373
Difference =	0·597

TABLE IV.—Additional Capacity of the Air, 1893.

1893. Date.	MONTH. January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
1	0·234	0·292	0·212	0·221	0·336	0·294	0·153	0·184	0·166	0·199	0·318	0·237
2	·186	·276	·205	·265	**·345**	·318	·125	·195	·148	·209	·366	·258
3	·239	·297	**·201**	·244	·310	·316	·133	·145	·203	·227	·405	·310
4	·278	·255	·209	·302	·275	**·325**	·135	·128	·167	·217	·406	·353
5	·250	·201	·206	·356	·235	·321	·113	·139	**·122**	·198	**·434**	·356
6	·206	·166	·230	·269	·283	·274	·099	·110	·146	·161	·421	·353
7	·239	·285	·230	·331	·309	·314	·141	·117	·126	·156	·364	·320
8	·259	·324	·231	·218	·326	·227	·169	**·102**	·142	**·133**	·255	·284
9	·295	**·380**	·222	·231	·319	·266	·155	·131	·188	·150	·257	·294
10	·271	·265	·209	**·213**	·293	·196	·163	·172	·201	·176	·269	·265
11	**·347**	·247	·233	·242	·303	·202	·188	·159	·211	·166	·223	·329
12	·277	·275	·218	·347	·314	·169	·204	·174	·194	·201	·227	·353
13	·283	·184	·255	·285	·324	·148	**·215**	·178	·206	·198	·261	·338
14	·268	·190	·345	·331	·276	·136	·211	·184	·172	·164	·336	·363
15	·256	·228	**·470**	·362	·276	·134	·207	·161	·167	·235	·272	·337
16	·221	·228	·359	**·527**	·275	·114	·184	·102	·162	**·391**	·200	**·397**
17	·265	·233	·249	·397	·269	·085	·179	·181	·138	·355	·158	·385
18	·300	·301	·209	·429	·283	·102	·192	·199	·171	·248	·146	·329
19.	·313	·316	·272	·427	·309	·109	·160	**·230**	·167	·273	·191	·378
20	·306	·273	·320	·385	·329	**·074**	·150	·229	·189	·345	·183	·308
21	·237	·211	·298	·288	·343	·092	**·093**	·214	·202	·331	**·128**	·313
22	·307	·157	·306	·271	·303	·086	·156	·203	·177	·258	·161	·288
23	·245	**·140**	·324	·288	·290	·156	·174	·221	·160	·286	·183	·292
24	·191	·186	·349	·286	·298	·161	·198	·200	·195	·283	·139	·275
25	·192	·249	·263	·282	·329	·169	·211	·198	·177	·309	·203	·240
26	·197	·255	·264	·286	·307	·167	·199	·210	·175	·247	·220	·191
27	·253	·233	·265	·305	·288	·170	·198	·191	·218	·216	·223	·212
28	**·176**	·243	·225	·362	·167	·181	·142	·128	**·236**	·230	·235	·284
29	·215		·205	·343	**·106**	·198	·200	·147	·212	·226	·241	·255
30	·310		·216	·336	·107	·178	·150	·129	·226	·260	·249	**·190**
31	·290		·208		·226		·179	·175		·306		·220
Monthly Mean.	0·255	0·246	0·258	**0·314**	0·282	0·190	**0·167**	0·169	0·179	0·237	0·256	0·299
Annual Variation ..	+·017	+·008	+·020	+·076	+·044	—·048	—·071	—·069	—·059	-·001	+·018	+·061

	in.
Annual mean	0·238
The greatest mean daily additional capacity of the air in the year (that of 16th April) was ...	0·527
The least do. do. do. (that of 20th June) was ...	0·074
Difference =	0·453

Maxima and Minima of different Meteorological Elements, 1893.

TABLE V.—*In which are collected the individual observations in each month of the year, which showed the greatest and the least values of the following elements, viz., Height of Barometer, corrected for Temperature; Temperature of Air; Pressure of Vapour; and Additional Capacity of Air.*

1893.	HEIGHT OF BAROMETER.			TEMPERATURE OF AIR.			PRESSURE OF VAPOUR.			ADDITIONAL CAPACITY.		
Month.	Greatest.	Least.	Range.	Greatest.	Least.	Range.	Greatest.	Least.	Range.	Greatest.	Least.	Range.
	in.	in.	in.	°	°	°	in.	in.	in.	in.	in.	in.
January...	30·050	29·783	0·267	85·0	62·9	22·1	0·766	0·314	0·452	0·743	0·072	0·671
February .	·081	·848	·233	84·1	59·8	24·3	·779	·253	·526	·848	·070	·778
March ...	·013	·690	·323	88·5	68·5	20·0	·860	·424	·436	·725	·071	·654
April ...	29·960	·623	·337	92·1	74·9	17·2	·956	·561	·395	·944	·094	·850
May ...	·906	·536	·370	89·7	76·4	13·3	·983	·749	·234	·503	·059	·444
June ...	·802	·432	·370	89·4	75·0	14·4	1·015	·782	·233	·522	·051	·471
July ...	·825	·584	·241	85·5	75·2	10·3	0·985	·759	·226	·318	·049	·269
August ...	·857	·559	·298	84·6	74·9	9·7	·957	·760	·197	·339	·052	·287
September.	·903	·648	·255	84·7	75·1	9·6	·958	·720	·238	·364	·057	·307
October ...	30·031	·637	·394	88·7	72·9	15·8	·995	·513	·482	·733	·054	·679
November.	·046	·749	·297	89·6	71·5	18·1	·904	·380	·524	·930	·056	·874
December.	·081	·781	·300	85·5	68·2	17·3	·841	·402	·439	·754	·077	·677
Year ...	30·081	29·432	0·649	92·1	59·8	32·3	1·015	0·253	0·762	0·944	0·049	0·895

Rainfall, 1893.

TABLE VI.—*Total fall of rain (in inches) as measured by F. Chambers's Self-registering Gauge, the funnel of which is 28 feet above the ground.*

1893. Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
		in.		in.	in.	in.	in.	in.	in.	in.	in.	
1							0·01	1·53	0·09			
2							0·34	0·06	0·79			
3							0·80	1·42	0·03	0·01		
4							2·48	1·05	0·34	0·32		
5							2·96	0·84	0·62			
6							2·13	1·79	0·01			
7							0·31	0·49	0·07			
8						0·47	0·15	0·94	0·28			
9							0·07	0·07	0·04			
10						2·40	0·18	0·05	0·08			
11						0·45	0·10	0·05		0·02		
12						0·01	0·35	0·01	0·04	0·03		
13						0·04	0·01	0·24				
14						0·23	0·16	0·25	0·16			
15				0·01		0·96	0·13	0·47	0·23		0·01	
16				0·01		0·08	0·14	1·13	0·47		0·05	
17						1·28	0·39	0·07	0·72		0·01	
18						2·03	0·25		0·87			
19						3·26	0·41	0·01	0·15			
20						4·98	0·89		0·02		0·02	
21						1·87	0·54	0·01			1·46	
22		0·12				2·62	0·17	0·21	0·17			
23							0·36		1·12			
24						0·08	0·01	0·11				
25						0·01	0·02	0·06	0·59			
26					0·02		0·06		0·18			
27					0·02	0·04	0·03	0·04				
28					[3·35]		0·59	1·34	0·01			
29					[1·49]	0·02	0·21	0·21				
30					1·08	0·26	0·77	0·09				
31					0·02		0·59	0·26				
Monthly Total.		0·12		0·02	5·98	21·09	15·61	12·80	7·08	0·38	1·55	
Number of rainy days.		1		2	6	19	31	27	23	4	5	

Total fall of rain in the year ... ... 64·63 inches.
Total number of rainy days in the year 118
The greatest daily fall of rain in the year (that of 20th June) was ... ... 4·98 inches.
No rain fell in the months of January, March and December, nor on any of the days left blank in the above table.

The entries in square brackets—May 28 and 29—are inferred from the simultaneous falls in Newman's Gauge.

Mean Daily Velocities of the North and East Components of the Wind, 1893.

TABLE VII.—*Showing the Mean Velocities of the North or South and East or West Components of the Winds which blew on each day of the year 1893.*

In Miles per Hour.

1893.	MONTH.																							
Date.	January.		February.		March.		April.		May.		June.		July.		August.		September.		October.		November.		December.	
	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.
1 ...	1·3 N	1·1 W	6·7 N	2·6 W	0·0	2·6 W	5·6 N	7·8 W	2·2 S	6·9 W	3·6 S	6·8 W	7·2 S	2·4 W	1·0 S	17·5 W	2·7 S	17·3 W	6·3 N	2·1 W	4·3 N	1·1 E	2·2 N	0·7 W
2 ...	1·9 N	3·2 W	10·6 N	2·9 W	2·5 N	2·5 W	8·8 N	6·7 W	0·8 S	6·3 W	4·9 S	4·9 W	4·1 S	3·2 W	3·6 S	19·1 W	3·9 S	20·4 W	4·1 N	3·6 W	6·0 N	3·7 E	4·3 N	2·1 W
3 ...	5·9 N	0·8 W	14·0 N	4·0 W	5·5 N	3·4 W	9·3 N	7·7 W	2·8 N	7·0 W	1·8 S	3·6 W	4·7 S	6·5 W	6·8 S	21·2 W	0·0	22·9 W	5·9 N	4·5 W	7·8 N	5·4 E	5·7 N	0·5 W
4 ...	7·8 N	1·7 W	4·1 N	0·0	3·2 N	3·4 W	15·1 N	9·0 W	8·1 N	9·5 W	0·5 N	5·4 W	6·3 S	18·8 W	1·1 S	24·3 W	0·8 N	17·9 W	3·4 N	3·6 W	6·5 N	7·5 E	4·5 N	2·5 E
5 ...	5·1 N	1·3 W	4·5 N	2·9 W	0·1 S	2·7 W	8·4 N	7·2 W	8·2 N	8·7 W	5·4 N	8·5 W	3·4 S	21·3 W	5·9 S	23·6 W	3·7 N	8·6 W	8·1 N	3·1 W	7·6 N	4·6 E	3·8 N	4·6 E
6 ...	13·5 N	4·3 W	4·9 N	1·8 W	4·8 N.	5·5 W	6·8 N	7·4 W	6·8 N	7·9 W	6·3 N	4·6 W	6·3 S	16·5 W	3·3 S	18·8 W	1·3 N	3·2 W	3·0 N	0·9 W	9·1 N	0·8 E	4·2 N	2·0 E
7 ...	11·2 N	2·8 W	15·8 N	7·5 W	5·9 N	4·8 W	8·6 N	7·7 W	3·4 N	7·1 W	2·9 N	3·9 W	8·0 S	18·7 W	3·6 S	18·0 W	2·1 N	4·4 W	2·8 N	1·2 W	9·0 N	4·3 E	5·3 N	2·1 E
8 ...	8·2 N	4·4 E	13·5 N	2·6 W	3·1 N	4·6 W	6·5 S	6·5 W	2·2 N	7·7 W	0·8 S	2·7 W	5·7 S	14·0 W	2·7 S	14·6 W	1·3 S	8·5 W	3·5 S	1·0 W	7·7 N	0·7 W	5·3 N	0·0
9 ...	7·7 N	4·9 E	11·0 N	0·2 E	0·0	3·6 W	1·6 N	4·9 W	10·0 N	9·0 W	3·6 N	7·0 W	5·2 S	10·4 W	6·0 S	14·7 W	0·0	16·6 W	2·0 S	0·8 E	6·9 N	0·0	2·6 N	1·1 E
10 ...	7·3 N	0·3 W	5·2 N	2·5 W	0·5 N	3·4 W	3·0 N	4·7 W	6·4 N	10·1 W	3·5 N	5·7 W	3·5 S	12·2 W	5·3 S	11·9 W	0·5 S	12·5 W	1·3 S	1·2 W	8·3 N	2·9 E	3·9 N	0·5 W
11 ...	4·0 N	3·4 E	8·1 N	5·1 W	0·4 N	3·6 W	2·2 S	4·3 W	2·9 N	9·6 W	0·6 S	0·5 E	2·4 S	13·1 W	6·3 S	12·8 W	0·8 S	7·8 W	0·3 S	4·3 W	5·6 N	0·2 W	5·5 N	4·0 E
12 ...	3·4 N	1·3 E	6·2 N	3·4 W	3·3 N	5·4 W	3·5 S	2·6 W	1·6 N	8·7 W	20·3 S	9·4 E	1·5 S	13·9 W	6·0 S	9·7 W	2·0 S	8·6 W	0·4 N	1·7 E	6·8 N	3·5 W	3·3 N	6·6 E
13 ...	4·0 N	0·9 E	1·7 N	0·6 W	7·0 N	5·7 W	3·6 S	2·6 W	4·5 N	9·5 W	24·6 S	6·0 E	2·6 S	16·6 W	4·2 S	11·6 W	0·9 N	9·6 W	4·0 S	2·8 W	3·8 N	3·7 E	3·9 N	2·4 E
14 ...	6·3 N	0·2 W	4·0 N	1·9 W	8·0 N	4·4 W	5·4 N	2·7 W	7·7 N	10·6 W	14·0 S	0·5 E	1·4 S	16·6 W	0·9 S	9·0 W	0·5 N	13·2 W	1·5 S	0·9 W	6·3 N	6·2 E	4·5 N	2·9 E
15 ...	5·4 N	1·4 W	9·7 N	5·6 W	7·7 N	3·2 W	9·6 N	6·7 W	9·3 N	11·0 W	1·7 S	4·9 W	6·9 S	17·2 W	0·8 S	9·8 W	3·3 S	17·8 W	2·9 N	2·2 W	0·1 N	12·6 E	5·6 N	5·7 E
16 ...	8·6 N	2·7 W	8·7 N	2·6 W	1·8 N	2·5 W	10·6 N	1·3 E	10·4 N	12·4 W	9·2 S	1·4 W	7·4 S	15·3 W	3·9 S	0·4 W	6·7 S	18·9 W	9·4 N	3·1 W	0·0	0·6 W	4·8 N	7·5 E
17 ...	11·7 N	3·2 W	14·2 N	5·5 W	0·2 S	5·7 W	16·3 N	7·7 W	8·5 E	10·4 W	4·4 S	6·6 W	7·4 S	17·2 W	0·0	5·9 W	1·1 N	16·6 W	6·6 N	4·0 W	2·0 N	3·3 W	5·1 N	5·0 E
18 ...	8·2 N	2·0 W	11·8 N	5·9 W	4·0 N	5·9 W	15·9 N	6·9 W	5·5 N	9·0 W	0·8 S	21·8 W	7·9 S	19·2 W	1·0 N	4·8 W	1·1 S	13·6 W	2·7 N	0·3 W	1·4 S	0·1 W	6·5 N	4·8 E
19 ...	8·6 N	3·1 W	12·8 N	4·8 W	7·1 N	5·1 W	10·5 N	5·0 W	2·9 N	8·1 W	2·9 S	29·2 W	7·5 S	13·4 W	4·0 N	5·9 W	0·8 N	12·7 W	5·4 N	0·8 E	11·2 S	1·1 E	5·1 N	5·5 E
20 ...	11·2 N	3·3 W	11·3 N	3·2 W	4·9 N	6·4 W	9·9 N	7·0 W	2·1 N	7·4 W	6·5 S	22·2 W	4·8 S	17·6 W	2·6 N	9·7 W	3·7 S	7·4 W	5·9 N	1·2 E	24·2 S	3·5 E	6·0 N	4·2 E
21 ...	8·8 N	2·2 W	3·1 N	4·6 W	3·9 N	4·5 W	2·6 N	6·3 W	0·3 S	6·3 W	6·8 S	23·4 W	0·6 S	5·1 W	3·6 N	12·3 W	3·6 S	5·0 W	3·9 N	3·6 E	7·3 S	0·3 W	5·1 N	1·8 E
22 ...	10·5 N	1·9 E	6·4 S	1·1 E	4·4 N	5·2 W	5·2 S	5·5 W	5·6 N	9·1 W	11·7 S	12·9 W	0·7 N	4·6 W	4·0 N	11·7 W	2·4 S	3·6 W	4·8 N	0·1 W	5·2 N	1·5 W	4·1 N	2·9 E
23 ...	1·9 N	1·0 W	5·9 S	1·2 W	7·7 N	3·7 W	5·6 S	5·5 W	6·5 N	11·3 W	14·3 S	9·1 W	3·1 N	4·3 W	1·8 N	12·6 W	3·3 S	2·7 W	4·8 N	0·1 W	9·6 N	3·0 W	2·1 N	2·1 E
24 ...	0·9 S	0·5 E	6·4 N	2·3 W	6·5 N	5·0 W	7·3 S	6·8 W	3·6 N	8·1 W	9·9 S	11·9 W	1·8 N	4·3 W	1·7 N	13·9 W	1·9 S	2·6 W	4·1 N	2·7 E	7·0 N	3·1 W	1·0 N	2·4 E
25 ...	6·8 N	0·7 W	13·9 N	6·2 W	1·3 N	4·0 W	4·0 S	6·7 W	2·3 N	9·7 W	9·2 S	10·1 W	3·3 S	7·6 W	1·0 S	15·6 W	0·0	1·2 W	3·9 N	2·7 E	1·6 N	1·6 W	3·5 N	1·2 E
26 ...	8·0 N	0·5 W	1·9 N	3·1 W	3·4 N	4·0 W	3·8 S	6·7 W	3·1 S	7·5 W	7·1 S	11·5 W	3·4 S	7·1 W	3·7 S	13·7 W	1·5 N	0·2 E	3·9 N	0·0	1·8 N	0·2 E	3·9 N	0·1 E
27 ...	5·3 N	0·1 W	3·3 S	3·7 W	6·6 N	7·3 W	8·0 S	7·1 W	3·5 S	5·2 W	6·9 S	15·5 W	2·6 S	8·7 W	3·1 S	14·4 W	0·1 N	2·2 W	4·1 N	0·6 E	1·8 N	0·1 W	5·5 N	0·9 W
28 ...	7·0 N	3·6 W	3·0 S	1·0 W	5·6 N	5·5 W	4·8 S	7·4 W	6·2 S	1·9 W	7·1 S	15·5 W	0·6 S	8·0 W	2·8 S	14·5 W	1·2 S	4·1 W	4·2 N	0·3 W	2·5 N	0·2 E	0·8 N	1·8 E
29 ...	10·9 N	4·2 W			4·9 N	5·9 W	3·4 S	6·9 W	4·8 S	2·4 W	6·6 S	12·5 W	1·8 N	17·0 W	3·8 S	13·5 W	0·6 N	1·1 W	2·9 N	0·3 W	4·3 N	0·7 W	0·4 S	0·7 E
30 ...	10·0 N	4·2 W			3·2 N	4·7 W	3·5 S	7·5 W	8·6 S	2·4 W	3·9 S	10·8 W	3·0 N	16·6 W	1·9 S	11·6 W	5·8 N	3·0 W	4·0 N	0·7 E	3·2 N	0·8 W	2·4 S	0·9 W
31 ...	11·7 N	2·7 W			6·3 N	6·4 W			3·5 S	8·2 W			2·9 N	19·2 W	2·4 S	12·5 W					4·9 N	2·9 E	2·3 S	1·1 E
Monthly Mean ...	7·1 N	1·1 W	6·6 N	3·1 W	4·0 N	4·5 W	2·9 N	6·0 W	2·8 N	8·0 W	5·2 S	8·5 W	3·2 S	12·5 W	2·0 S	13·2 W	0·5 S	9·5 W	3·2 N	0·7 W	3·0 N	1·3 E	3·6 N	2·2 E
Annual Variation ...	5·2 N	4·2 E	4·7 W	2·2 E	2·1 N	0·8 E	1·0 N	0·7 W	0·9 N	2·7 W	7·1 S	3·2 W	5·1 S	7·2 W	3·9 S	7·9 W	2·4 S	4·2 W	1·3 N	4·6 E	1·1 N	6·6 E	1·7 N	7·5 E

The Velocities of the Mean Components for the year are 1·9 N. and 5·3 W.

Velocity of Wind, 1893.

TABLE VIII.—*Mean Velocity of the Wind, in miles per hour, without regard to the direction from which it blew, for each Day of Bombay Civil Time: also the Mean Monthly Velocity, and its Variation from the Mean of the year.*

1893	MONTH.											
Date.	January.	February.	March.	April.	May.	June.	July.	August.	September	October.	November	December.
	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.
1	6·0	9·4	5·0	10·3	7·6	7·9	11·4	17·7	17·8	8·3	9·1	6·5
2	5·5	13·3	5·9	11·8	6·6	7·9	8·5	20·0	21·2	7·3	11·4	8·5
3	7·9	15·3	8·3	12·7	8·6	6·9	11·8	22·5	22·9	8·0	12·3	8·8
4	9·1	7·5	6·4	18·2	13·9	7·4	20·2	24·6	18·2	6·5	12·2	8·5
5	8·0	7·0	5·5	13·5	13·5	10·3	22·3	24·7	13·6	10·5	12·0	10·2
6	14·9	9·0	8·7	13·2	11·1	9·4	18·2	19·8	6·3	7·3	13·0	8·2
7	12·6	18·5	9·6	11·9	8·7	9·4	20·4	18·7	7·6	6·0	15·3	10·0
8	12·8	15·3	7·8	11·4	8·2	7·4	15·2	15·6	12·7	6·2	10·7	7·6
9	13·4	12·9	7·4	7·1	14·2	8·1	12·7	16·2	16·6	5·5	11·2	7·7
10	10·4	8·2	5·6	7·7	12·4	9·5	12·9	13·0	12·6	5·4	11·3	8·0
11	12·6	10·4	6·3	7·4	10·2	8·8	13·7	14·6	8·0	4·7	8·2	13·4
12	8·4	8·3	7·5	12·1	9·2	23·2	14·2	11·7	9·2	8·0	8·9	12·8
13	7·8	6·8	11·2	9·5	10·7	26·0	17·1	13·0	9·7	7·7	10·6	9·7
14	9·7	9·1	12·9	12·2	13·7	17·6	16·9	9·5	13·4	4·9	9·0	9·4
15	8·2	11·8	10·8	12·5	15·5	9·7	18·5	10·1	18·5	9·9	13·8	10·9
16	10·3	11·1	6·7	12·3	16·7	17·6	17·5	7·4	20·3	11·5	5·1	12·6
17	13·4	15·7	8·2	18·6	14·4	11·0	18·7	6·4	16·8	8·8	5·3	12·5
18	10·3	14·2	9·5	18·2	10·8	22·0	20·7	6·7	14·0	7·7	5·7	10·9
19	10·7	14·2	9·7	13·6	9·4	30·0	16·2	8·5	15·6	9·2	13·3	11·4
20	12·7	13·1	8·9	12·4	7·9	23·5	18·6	10·2	9·6	8·6	24·9	10·4
21	10·4	6·3	8·7	9·1	6·3	24·8	7·8	13·0	6·8	10·1	9·4	9·0
22	13·1	8·5	10·4	8·2	11·3	18·6	7·2	12·5	6·2	7·3	8·3	9·6
23	5·8	7·6	11·4	8·3	13·5	17·2	7·6	13·0	6·4	8·9	11·0	8·9
24	5·4	10·5	10·2	10·6	9·2	15·8	6·5	14·2	6·1	9·1	8·5	6·6
25	10·7	16·2	7·4	8·0	10·6	13·7	9·5	15·8	6·2	8·4	5·5	6·8
26	11·6	7·0	7·7	7·9	8·4	13·7	9·3	14·5	8·5	6·9	7·2	6·8
27	8·1	6·4	12·0	10·9	8·2	17·1	10·5	15·0	5·7	7·3	6·0	7·7
28	8·8	7·7	9·2	9·0	9·0	17·2	10·2	15·2	6·7	6·7	6·3	7·5
29	12·9		9·1	8·7	8·0	14·3	17·5	14·3	6·9	6·5	6·7	6·8
30	12·0		8·3	9·0	11·9	12·0	17·3	12·7	8·4	7·6	6·5	6·7
31	12·7		10·9		9·0		19·7	13·0		9·1		7·2
Monthly Mean .	10·2	10·8	8·6	11·2	10·6	14·6	14·5	14·3	11·7	7·7	10·0	9·1
Annual Variation	—0·9	—0·3	—2·5	+0·1	—0·5	+3·5	+3·4	+3·2	+0·6	—3·4	—1·1	—2·0

	Miles.
The Mean Velocity for June to August	14·5
The Mean Velocity for September to May	10·0
The Mean Velocity for the year	11·1
The greatest monthly mean (that of June)	14·6
The least monthly mean (that of October)	7·7
Difference = ...	6·9

The greatest mean daily Velocity of Wind in the year (that of 19th June) was ... ... 30·0
The least do. do. do. (that of 11th October) was ... 4·7

Difference = ... 25·3

Aggregate and Mean Velocities and Relative Frequency of Different Winds, 1893.

TABLE IX.—*Showing, for the year 1893, the sums of the Velocities, and the Mean Velocities, in miles per hour, of the Winds which blew in each Month, from each of the sixteen Principal Directions: and also the number of hourly Observations which those sums comprise; the latter numbers indicating the Relative frequency of the same Wind (as to direction) in the several Months, and of different Winds during the same Month.*

1893.	N.			N.N.E.			N.E.			E.N.E.			E.			E.S.E.			S.E.			S.S.E.		
Month.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.
	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.
January ...	1,108	134	8·3	751	114	6·6	449	58	7·7	754	75	10·1	251	33	7·6	139	17	8·2	1	1	1·0	0	0	0·0
February ...	1,024	118	8·7	337	45	7·5	207	28	7·4	262	34	7·7	192	30	6·4	116	18	6·4	56	8	7·0	61	8	7·6
March ...	257	43	6·0	370	65	5·7	100	15	6·7	221	37	6·0	222	48	4·6	93	23	4·0	31	7	4·4	24	5	4·8
April ...	446	54	8·3	128	21	6·1	123	14	8·8	80	16	8·0	81	10	8·1	7	2	3·5	46	7	6·6	58	5	11·6
May ...	25	5	5·0	99	16	6·2	21	5	4·2	11	2	5·5	13	1	13·0	31	5	6·2	18	2	9·0	116	8	14·5
June... ...	58	12	4·8	6	1	6·0	18	3	6·0	30	3	10·0	132	17	7·8	110	15	7·3	242	18	13·4	1,142	63	18·1
July ...	29	7	4·1	21	5	4·2	20	3	6·7	21	4	5·2	36	6	6·0	8	2	4·0	88	12	7·3	145	13	11·2
August ...	0	0	0·0	8	2	4·0	0	0	0·0	21	4	5·2	13	2	6·5	42	6	7·0	30	7	4·3	14	2	7·0
September ...	37	4	9·2	59	13	4·5	13	2	6·5	29	6	4·8	59	8	7·4	210	30	7·0	148	22	6·7	87	9	9·7
October ...	261	42	6·2	206	35	5·9	373	69	5·4	815	101	8·1	311	46	6·8	182	30	6·1	179	30	6·0	97	16	6·1
November...	538	87	6·2	206	31	6·6	884	100	8·8	1,087	107	10·2	566	65	8·7	263	24	11·0	27	3	9·0	336	15	22·4
December ...	541	82	6·6	127	26	4·9	457	62	7·4	1,415	143	9·9	1,110	119	9·3	522	51	10·2	66	10	6·6	17	2	8·5
Year ...	4,324	588	7·4	2,318	374	6·2	2,665	359	7·4	4,746	526	9·0	2,986	385	7·8	1,723	223	7·7	932	127	7·3	2,097	146	14·4

1893.	S.			S.S.W.			S.W.			W.S.W.			W.			W.N.W.			N.W.			N.N.W.			No. of Observations.		No. of hours.
Month.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Calm	Variable.	Record lost.
	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.			
January ...	7	3	2·3	6	0	0·0	0	0	0·0	94	14	6·7	211	29	7·3	244	27	9·0	1,840	431	14·0	1,740	107	16·3	1	0	0
February ...	123	12	10·2	133	15	8·9	55	11	5·0	132	14	9·4	156	21	7·4	481	48	10·0	1,978	149	13·3	1,917	112	17·1	1	0	0
March ...	32	6	5·3	29	5	5·8	16	5	3·2	87	11	7·9	672	77	8·7	2,186	189	11·6	1,681	160	10·5	390	45	8·7	3	0	0
April ...	166	18	9·2	606	54	11·2	740	93	8·0	991	106	9·3	451	43	10·5	491	52	9·4	2,129	133	16·0	1,533	96	16·0	2	0	0
May ...	204	21	9·7	164	19	8·6	189	29	6·5	676	84	8·0	1,027	131	7·8	2,913	226	12·9	2,142	166	12·7	272	24	11·3	0	0	0
June ...	552	28	19·7	511	33	15·5	1,380	108	12·8	3,192	192	16·6	1,943	110	17·7	734	71	10·3	356	35	10·2	104	11	9·5	0	0	0
July ...	173	19	9·1	213	21	10·1	359	37	9·7	5,378	319	16·9	3,366	225	15·0	803	55	14·6	56	8	7·0	61	8	7·6	0	0	0
August ...	11	2	5·5	68	6	11·3	305	28	10·9	4,465	283	15·8	4,315	282	15·3	1,288	108	11·9	77	10	7·7	9	2	4·5	0	0	0
September ...	78	9	8·1	83	18	4·6	121	19	6·4	1,650	124	13·3	4,532	326	13·9	906	83	10·9	293	36	8·1	112	11	10·2	0	0	0
October ...	169	23	7·3	38	5	7·6	65	14	4·6	14	2	7·0	205	27	7·6	775	88	8·8	1,339	138	9·7	729	75	9·7	3	0	0
November ...	600	33	18·2	119	13	9·2	19	3	6·3	95	13	7·3	274	37	7·4	396	45	8·8	855	81	10·6	909	62	14·7	1	0	0
December ...	0	0	0·0	22	4	5·5	7	1	7·0	87	11	7·9	309	46	6·7	416	43	9·7	867	81	10·7	802	63	12·7	0	0	0
Year ...	2,110	174	12·1	1,986	193	10·3	3,256	348	9·4	16,861	1,173	14·4	17,461	1,354	12·9	11,633	1,035	11·2	13,583	1,128	12·0	8,578	616	13·9	11	0	0

Temperature of the Ground, 1893.

TABLE X.—*Showing, for each Month, the Mean Temperature of the Ground, and its Annual Variation, at the respective depths of 1, 9, 20, 60 and 132 inches below the surface.*

Depth.	1 Inch.		9 Inches.		20 Inches.		60 Inches.		132 Inches.	
Month.	Mean Temperature.	Excess over the yearly Mean.	Mean Temperature.	Excess over the yearly Mean.	Mean Temperature.	Excess over the yearly Mean.	Mean Temperature.	Excess over the yearly Mean.	Mean Temperature.	Excess over the yearly Mean.
	°	°	°	°	°	°	°	°	°	°
January ...	75·4	—5·5	76·2	—4·6	79·4	—3·5	81·8	—1·8	81·8	—1·0
February ...	74·8	—6·1	75·0	—5·8	78·0	—4·9	80·9	—2·7	81·4	—1·4
March	79·6	—1·3	78·6	—2·2	79·9	—3·0	80·9	—2·7	81·2	—1·6
April	84·5	+3·6	83·1	+2·3	83·2	+0·3	82·3	—1·3	81·5	—1·3
May	85·6	+4·7	84·9	+4·1	85·6	+2·7	84·5	+0·9	82·3	—0·5
June	83·4	+2·5	83·8	+3·0	85·8	+2·9	85·6	+2·0	83·2	+0·4
July	82·1	+1·2	82·5	+1·7	84·8	+1·9	85·3	+1·7	84·0	+1·2
August... ...	81·4	+0·5	81·8	+1·0	83·9	+1·0	84·6	+1·0	84·0	+1·2
September ...	81·4	+0·5	81·6	+0·8	83·6	+0·7	84·3	+0·7	83·7	+0·9
October ...	82·2	+1·3	82·0	+1·2	84·0	+1·1	84·3	+0·7	83·6	+0·8
November ...	81·5	+0·6	81·3	+0·5	83·7	+0·8	84·3	+0·7	83·4	+0·6
December ...	78·9	—2·0	79·3	—1·5	82·5	—0·4	84·2	+0·6	83·3	+0·5
Year ...	80·9		80·8		82·9		83·6		82·8	

Extent of Cloudy Sky, 1893.

TABLE XI.—*Means of Estimations made at 6, 10, 14, 16 and 22 hours daily, the whole Sky being reckoned as 10.*

1893.	MONTH.											
Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1		0·4	1·0	1·6	2·0	8·4	9·2	9·2	10·0	7·4		3·8
2	0·8			0·6	1·6	2·4	9·8	9·0	9·0	0·8		
3	0·2		2·2	0·8	4·2	1·8	9·4	10·0	8·4	3·4		0·4
4	7·0		0·4	0·4	2·0	4·0	10·0	10·0	9·2	1·2	0·4	2·0
5	2·6		5·2	0·2	0·8	6·2	9·8	9·8	10·0	2·2		5·6
6	6·0		0·4		3·0	7·6	10·0	10·0	6·6	2·8	0·4	2·0
7	0·4	1·2	5·8		3·6	5·6	10·0	10·0	9·8		1·4	
8	0·2		1·6	0·6	0·8	5·0	8·4	10·0	8·6	0·4	2·0	
9	0·4		0·6	0·4	1·4	5·6	10·0	10·0	7·2	1·6	4·0	
10	2·0		1·6		3·4	7·8	10·0	9·0	6·0	2·0	0·2	4·0
11			0·6	0·4	1·6	8·2	6·6	8·0	4·8	1·8	2·8	3·8
12			1·2	2·0	2·4	8·8	5·0	9·4	8·0	7·4	3·4	3·6
13				9·6	1·0	8·2	5·6	6·0	8·4	2·6	4·6	5·6
14		1·0	0·2	9·4	1·8	9·8	4·4	7·4	9·0	3·8	4·6	5·6
15			0·4	8·2	1·0	9·8	9·2	6·6	9·2	1·0	8·6	5·6
16				9·4	2·6	10·0	9·0	9·6	7·8	0·8	7·0	6·6
17				7·2	6·2	10·0	9·4	4·0	10·0	1·6	2·2	4·2
18			0·6	6·2	4·2	10·0	5·0	3·6	9·6	1·4	4·8	5·4
19				0·2	2·8	10·0	9·8	8·4	7·4		4·0	0·8
20					3·2	10·0	7·0	10·0	6·6	1·6	1·6	1·4
21		0·2		0·6	0·4	10·0	9·8	9·6	5·4	0·4	5·6	
22		4·0	0·2	3·8	2·6	9·4	9·0	10·0	7·4		2·0	
23		3·0		2·0	1·0	4·6	9·6	9·4	5·4	0·6	2·0	
24		7·0		1·4	1·0	9·0	8·2	9·6	3·8		3·0	
25				3·0	1·2	5·2	8·0	8·2	7·6		2·6	0·2
26			0·2	3·8	4·0	9·0	6·8	7·0	7·4		0·6	6·2
27	1·4			3·8	5·4	7·0	8·8	9·2	3·8			0·4
28		1·2		3·8	10·0	9·6	9·6	10·0	4·4	3·2	0·2	
29	0·2		0·8	2·2	10·0	5·0	9·4	9·6	2·2	1·4	0·2	
30				1·2	10·0	9·8	10·0	8·8	6·2	0·2	0·4	
31					8·0		10·0	10·0		0·8		
Monthly Mean.	0·7	0·6	0·7	2·8	3·3	7·6	8·6	8·8	7·3	1·6	2·3	2·2
Annual Variation.	−3·2	−3·3	−3·2	−1·1	−0·6	+3·7	+4·7	+4·9	+3·4	−2·3	−1·6	−1·7

For the days which have no entry, 0·0 is to be understood.

Mean of the months from January to April, November and December ... ... 1·5

Mean of the months from May to October ... ... 6·2

Mean for the year ... ... 3·9

Rainfall, 1893.

TABLE XII.—*Total Fall of Rain (in inches) as measured by Newman's Gauge, placed 4½ feet above the ground.*

1893. Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
		in.		in.	in.	in.	in.	in.	in.	in.	in.	
1							0·01	1·61	0·10			
2							0·34	0·06	0·84			
3							0·82	1·47	0·03	0·01		
4							2·32	1·12	0·37	0·36		
5							3·08	0·92	0·64			
6						0·01	2·24	1·89	0·01	0·01		
7							0·32	0·51	0·08			
8						0·57	0·15	1·01	0·30			
9							0·09	0·06	0·05			
10						2·47	0·18	0·07	0·07			
11						0·53	0·10	0·06		0·03		
12						0·03	0·37	0·02	0·04	0·04		
13						0·06	0·02	0·26				
14						0·26	0·16	0·25	0·19			
15				0·01		0·99	0·12	0·49	0·24		0·01	
16				0·01		0·11	0·15	1·16	0·48		0·06	
17						1·29	0·42	0·07	0·76		0·01	
18						2·01	0·26		0·97			
19						3·11	0·45	0·02	0·15			
20						4·97	0·94		0·02		0·03	
21						1·92	0·58	0·01			1·52	
22		0·13				2·67	0·18	0·21	0·21			
23							0·39		1·18			
24		0·01				0·12	0·02	0·13				
25						0·01	0·03	0·07	0·60			
26					0·04	0·01	0·06	0·01	0·19			
27					0·04	0·05	0·04	0·07				
28					3·52		0·62	1·39	0·01			
29					1·56	0·02	0·24	0·25				
30					1·12	0·26	0·81	0·09	0·01			
31					0·02		0·63	0·27				
Monthly Total.		0·14		0·02	6·30	21·47	16·14	13·55	7·54	0·45	1·63	
Number of rainy days		2		2	6	21	31	28	24	5	5	

Total fall of rain in the year ... ... 67·24 inches.
Total number of rainy days in the year 124
The greatest daily fall of rain in the year (that of 20th June) was ... ... 4·97 inches.
No rain fell in the months of January, March, and December, nor on any of the days left blank in the above table.

Table XIII.—Five-day Means, 1893.

Number of Five-day Period.	Barometric Pressure.	Temperature of the Air.	Pressure of Vapour.	Additional Capacity of the Air.	*Rainfall.	North or South Component of Wind.	East or West Component of Wind.	Number of Five-day Period.	Barometric Pressure.	Temperature of the Air.	Pressure of Vapour.	Additional Capacity of the Air.	*Rainfall.	North or South Component of Wind.	East or West Component of Wind.
	In.	°	In.	In.	In.	Miles.	Miles.		In.	°	In.	In.	In.	Miles.	Miles.
1	29·940	74·2	0·611	0·237		4·4 N.	1·6 W.	38	29·658	80·0	0·889	0·135	5·88	5·7 S.	16·2 W.
2	·923	74·0	·593	·254		9·6 N.	0·4 E.	39	·694	81·8	·891	·196	0·83	2·3 S.	14·5 W.
3	·855	74·0	·559	·286		4·6 N.	0·8 E.	40	·662	81·3	·885	·184	1·40	7·4 S.	16·5 W.
4	·880	71·2	·486	·281		9·7 N.	2·9 W.	41	·681	80·2	·878	·154	2·11	0·0	7·2 W.
5	·886	72·2	·563	·234		5·4 N.	0·3 W.	42	·703	80·5	·851	·190	0·99	1·4 S.	9·7 W.
6	·947	72·5	·573	·230		8·2 N.	2·5 W.	43	·699	79·9	·852	·171	4·58	1·1 S.	18·7 W.
7	·936	71·1	·488	·282		9·4 N.	2·4 W.	44	·640	79·0	·870	·119	5·45	3·3 S.	19·9 W.
8	·950	71·0	·494	·271		9 9 N.	2·9 W.	45	·751	80·2	·868	·163	0·47	5·6 S.	12·1 W.
9	·926	72·0	·559	·232		5·0 N.	2·7 W.	46	·778	79·4	·841	·165	1·97	0·9 S.	6·0 W.
10	·944	72·1	·530	·261		11·4 N.	4·9 W.	47	·757	81·0	·838	·219	0·24	3·2 N.	10·4 W.
11	·926	73·3	·631	·193	0·14	1·7 N.	2·0 W.	48	·730	80·2	·847	·185	1·67	1·8 S.	14·4 W.
12	·954	72·8	·574	·238		1·9 N.	3·3 W.	49	·724	79·7	·861	·153	1·55	2·9 S.	15·1 W.
13	·936	75·6	·679	·210		3·2 N.	3·5 W.	50	·745	79·4	·853	·153	1·13	1·6 N.	11·4 W.
14	·930	76·0	·677	·225		2·0 N.	4·0 W.	51	·716	80·0	·840	·187	0·46	0·1 S.	10·8 W.
15	·841	79·7	·688	·329		5·6 N.	4·2 W.	52	·811	79·9	·851	·169	1·67	1·5 S.	15·2 W.
16	·802	77·4	·675	·270		3·9 N.	5·5 W.	53	·798	79·6	·832	·181	1·35	2·0 S.	8·5 W.
17	·794	77·6	·652	·301		4·7 N.	4·4 W.	54	·799	79·4	·823	·185	1·97	0·7 S.	1·7 W.
18	·877	78·3	·747	·224		5·3 N.	6·0 W.	55	·816	80·8	·836	·216	0·02	3·1 N.	2·8 W.
19	·860	80·8	·779	·278		9·4 N.	7·7 W.	56	·768	80·3	·846	·192	0·38	4·6 N.	2·7 W.
20	·859	81·0	·810	·252		2·7 N.	6·2 W.	57	·745	81·7	·919	·165	0·07	1·1 S.	0·5 W.
21	·812	83·5	·839	·313	0·01	1·1 N.	3·8 W.	58	·743	81·9	·825	·269		2·7 N.	2·6 W.
22	·730	84·5	·757	·433	0·01	12·6 N.	5·0 W.	59	·882	78·9	·701	·291		4·5 N.	1·0 E.
23	·761	82·6	·833	·283		3·9 S.	6·2 W.	60	·924	78·9	·725	·268		4·2 N.	1·2 E.
24	·723	83·5	·823	·326		4·7 S.	7·1 W.	61	·919	79·1	·731	·268		4·1 N.	0·8 E.
25	·777	82·9	·826	·300		3·2 N.	7·7 W.	62	·936	79·4	·607	·406		7·4 N.	4·3 E.
26	·819	84·0	·861	·310		5·8 N.	8·4 W.	63	·860	79·0	·722	·274		7·5 N.	1·3 E.
27	·797	84·0	·868	·299		5·2 N.	9·9 W.	64	·854	80·8	·795	·259	0·07	3·4 N.	3·7 E.
28	·792	83·5	·856	·293		5·9 N.	9·5 W.	65	·885	78·8	·824	·161	1·56	8·4 S.	0·3 E.
29	·732	84·6	·877	·313		3·5 N.	8·9 W.	66	·924	77·6	·768	·181		5·0 N.	1·8 W.
30	·622	82 6	·924	·195	6·28	5·2 S.	3·9 W.	67	·946	80·0	·789	·237		2·8 N.	0·4 W.
31	·724	83·9	·870	·296	0·02	2·7 S.	5·8 W.	68	·957	79·2	·676	·326		4·5 N.	1·3 E.
32	·680	84·7	·914	·280	0·58	3·5 N.	5·3 W.	69	·988	77·3	·645	·298		4·5 N.	1·3 E.
33	·636	81·7	·915	·170	3·35	11·2 S.	2·1 E.	70	·999	75·8	·550	·358		4·4 N.	5·0 E.
34	·567	79·4	·896	·111	7·51	3·8 S.	12·8 W.	71	·990	75·9	·559	·343		5·6 N.	3·9 E.
35	·629	79·4	·893	114	9·68	9·8 S.	15·9 W.	72	·923	74·3	·599	·257		2·9 N.	1·7 E.
36	·654	82·0	·917	·177	0·09	7·4 S.	13·0 W.	73	·890	75·6	·660	·232		0·2 N.	0·4 E.
37	·722	79·9	·877	·145	3·75	5·2 S.	8·3 W.								

* Five-day sums, *not means*.

TABLES OF RESULTS

OF

ABSOLUTE MAGNETICAL OBSERVATIONS,

1893.

Absolute Magnetical Observations.—Table I.

Observations of Vibration and Deflection, taken with the Kew Unifilar Magnetometer (No. 23, by Elliott Brothers), for the determination of Absolute Horizontal Force.

1893.

1893. Date.	Civil Time, Mean.	Magnet N. 23 *a*. Time of one Vibration.	Effect of 90° Torsion.	Temperature.	Rate of Chronometer.	Corresponding Mean Reading of L. H. F. Magnetometer. Scale Reading.	Thermometer.	Angle of Deflection of Magnet N. 23 *c* by N. 23 *a* at Distance. 0·8 foot.	1·0 foot.	Temperature.	Corresponding Mean Reading of L. H. F. Magnetometer. Scale Reading.	Thermometer.	Observer.	Calculated Results in English Units. Values of m.	Values of X: From Deflections at distance. 0·8 foot ($X_{0\cdot8}$)	1·0 foot ($X_{1\cdot0}$)	Difference. $X_{0\cdot8}-X_{1\cdot0}$	Mean. $\frac{X_{0\cdot8}+X_{1\cdot0}}{2}$	Monthly Mean Values of X.	Monthly Mean Values of X in Metrical Units.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
	h. m.	s.	Sc. div.	°	s.		°	° ′ ″	° ′ ″	°		°								
JANUARY 4	12 9	2·8379	·0·68	81·7	+ 9·3	16·39	77·5	17 30 17	8 53 52	81·0	15·97	77·9	V.G.G.	·63779	8·1212	8·1201	+ ·0011	8·1206		
„ „	15 16	2·8393	0·74	80·4	„	15·35	79·3	17 30 57	8 54 10	82·3	15·55	79·0	V.G.G.	·63793	8·1124	8·1115	+ ·0009	8·1119		
„ 11	12 23	2·8389	0·77	85·0	+ 9·3	15·82	79·5	17 29 55	8 53 35	84·2	15·63	80·2	D.	·63803	8·1195	8·1191	+ ·0004	8·1193		
„ „	15 36	2·8394	0·82	83·9	„	15·25	82·1	17 30 15	8 53 47	85·8	15·33	81·4	D.	·63807	8·1143	8·1135	+ ·0008	8·1139		
„ 18	12 7	2·8374	0·87	79·5	+ 13·8	17·34	76·0	17 29 40	8 53 30	78·6	17·11	76·5	V.G.G.	·63750	8·1253	8·1246	+ ·0007	8·1249	8·1178	3·7430
„ „	15 19	2·8382	0·87	79·0	„	16·38	78·9	17 30 2	8 53 39	79·5	16·63	77·4	V.G.G.	·63762	8·1204	8·1199	+ ·0005	8·1201		
„ 25	12 14	2·8392	0·82	83·2	+ 10·8	16·54	78·4	17 30 5	8 53 40	81·8	16·43	79·0	D.	·63773	8·1186	8·1182	+ ·0004	8·1184		
„ „	15 32	2·8396	0·85	80·2	„	15·89	79·8	17 30 32	8 53 52	81·6	16·07	79·4	D.	·63762	8·1133	8·1132	+ ·0001	8·1132		
FEBRUARY 1	12 10	2·8379	0·83	81·0	+ 13·4	17·19	75·2	17 29 56	8 53 37	79·4	16·85	76·3	V.G.G.	·63762	8·1234	8·1229	+ ·0005	8·1231		
„ „	15 20	2·8384	0·81	80·8	„	16·43	78·0	17 29 45	8 53 32	80·7	16·66	77·6	V.G.G.	·63771	8·1216	8·1208	+ ·0008	8·1212		
„ 8	12 14	2·8382	0·78	78·0	+ 11·5	17·00	72·1	17 30 24	8 53 52	77·3	17·02	73·2	D.	·63750	8·1203	8·1195	+ ·0008	8·1199		
„ „	15 35	2·8382	0·80	77·0	„	16·36	76·0	17 31 15	8 54 21	78·5	16·63	75·2	D.	·63778	8·1152	8·1139	+ ·0013	8·1145	8·1194	3·7437
„ 15	12 17	2·8378	0·81	80·4	+ 10·0	16·62	77·1	17 30 25	8 53 52	79·6	16·37	77·6	V.G.G.	·63775	8·1210	8·1203	+ ·0007	8·1206		
„ „	15 19	2·8390	0·85	78·9	„	15·35	78·9	17 31 12	8 54 15	80·0	15·88	78·6	V.G.G.	·63793	8·1128	8·1120	+ ·0008	8·1124		
„ 22	12 13	2·8381	0·78	82·2	+ 10·9	16·87	77·9	17 29 0	8 53 5	81·8	16·64	78·2	D.	·63751	8·1251	8·1249	+ ·0002	8·1250		
„ „	15 36	2·8389	0·80	81·5	„	15·73	79·6	17 29 47	8 53 27	82·3	16·07	79·1	D.	·63775	8·1190	8·1188	+ ·0002	8·1189		
MARCH 1	12 12	2·8370	0·86	83·2	+ 9·2	17·45	78·4	17 27 37	8 52 25	82·5	17·20	79·1	V.G.G.	·63746	8·1334	8·1330	+ ·0004	8·1332		
„ „	15 19	2·8384	0·84	82·8	„	16·32	80·2	17 27 52	8 52 35	83·4	16·69	79·8	V.G.G.	·63750	8·1272	8·1266	+ ·0006	8·1269		
„ 8	13 24	2·8387	0·82	84·5	+ 8·7	16·31	80·6	17 28 27	8 52 55	84·1	16·13	81·0	D.	·63757	8·1249	8·1240	+ ·0009	8·1244		
„ „	15 33	2·8405	0·80	84·0	„	15·62	81·8	17 28 50	8 53 5	84·4	15·82	81·3	D.	·63740	8·1180	8·1171	+ ·0009	8·1175		
„ 15	12 12	2·8411	0·79	85·2	+ 7·7	15·65	83·6	17 27 15	8 52 15	88·8	15·22	84·6	V.G.G.	·63716	8·1214	8·1210	+ ·0004	8·1212		
„ „	15 25	2·8424	0·80	86·2	„	13·87	85·9	17 29 30	8 53 20	89·3	14·30	85·5	V.G.G.	·63775	8·1072	8·1070	+ ·0002	8·1071	8·1194	3·7438
„ 22	12 28	2·8384	0·80	84·9	+ 10·2	16·75	80·4	17 27 20	8 52 22	85·3	16·55	80·8	D.	·63743	8·1296	8·1285	+ ·0011	8·1290		
„ „	16 12	2·8412	0·78	83·2	„	15·68	82·1	17 28 0	8 52 40	85·9	15·92	81·6	D.	·63707	8·1171	8·1163	+ ·0008	8·1167		
„ 29	12 33	2·8415	0·77	86·0	+ 8·5	15·68	81·7	17 28 50	8 53 12	86·1	15·52	82·0	D.	·63735	8·1152	8·1135	+ ·0017	8·1143		
„ „	15 50	2·8418	0·82	84·4	„	14·74	83·1	17 30 2	8 53 45	86·5	14·76	82·8	D.	·63759	8·1079	8·1066	+ ·0013	8·1072		

1893. Date.	Civil Time, Mean.	Magnet N. 23 a. Time of one Vibration.	Effect of 90° Torsion.	Temperature.	Rate of Chronometer.	Corresponding Mean Reading of L. H. F. Magnetometer. Scale Reading.	Thermometer.	Angle of Deflection of Magnet N. 23 c by N. 23 a at Distance. 0·8 foot.	1·0 foot.	Temperature.	Corresponding Mean Reading of L. H. F. Magnetometer. Scale Reading.	Thermometer.	Observer.	Calculated Results in English Units. Values of m.	Values of X. From Deflections at distance. 0·8 foot ($X_{0\cdot8}$)	1·0 feet ($X_{1\cdot0}$)	Difference. $X_{0\cdot8}-X_{1\cdot0}$	Mean. $\frac{X_{0\cdot8}+X_{1\cdot0}}{2}$	Monthly Mean Values of X.	Monthly Mean Values of X in Metrical Units.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
	h. m.	s.	Sc. div.	°	s.			° ′ ″	° ′ ″	°										
April 5	12 43	2·8399	0·84	88·2	+7·2	16·23	84·7	17 26 7	8 51 55	88·6	15·90	85·4	D.	·63718	8·1294	8·1272	+·0022	8·1283		
„ „	16 2	2·8412	0·82	88·3	„	14·78	86·2	17 26 50	8 52 15	88·6	15·17	86·2	D.	·63740	8·1231	8·1210	+·0021	8·1220		
„ 12	12 18	2·8410	0·79	91·1	+6·3	15·41	86·2	17 26 40	8 52 8	91·1	15·02	86·7	G. S. J.	·63741	8·1244	8·1225	+·0019	8·1234		
„ „	15 25	2·8442	0·78	90·8	„	14·09	87·9	17 27 29	8 52 28	91·4	14·46	87·6	G. S. J.	·63722	8·1115	8·1104	+·0011	8·1109		
„ 19	12 26	2·8413	0·84	90·8	+8·0	15·60	87·1	17 26 27	8 51 57	91·3	15·17	87·7	D.	·63728	8·1236	8·1225	+·0011	8·1230	8·1206	3·7442
„ „	16 15	2·8428	0·86	90·7	„	14·58	88·2	17 27 36	8 52 27	91·0	14·61	88·3	D.	·63737	8·1152	8·1147	+·0005	8·1149		
„ 26	12 37	2·8418	0·88	92·0	+7·8	15·48	87·6	17 25 36	8 51 28	92·2	15·35	87·8	G. S. J.	·63712	8·1259	8·1251	+·0008	8·1255		
„ „	15 24	2·8434	0·85	91·5	„	14·54	88·6	17 26 16	8 51 49	92·9	14·88	88·1	G. S. J.	·63715	8·1176	8·1167	+·0009	8·1171		
May 3	12 21	2·8416	0·79	90·9	+9·4	15·99	86·9	17 24 35	8 51 1	91·4	15·76	87·1	D.	·63672	8·1302	8·1291	+·0011	8·1296		
„ „	15 56	2·8424	0·84	89·0	„	14·94	88·0	17 25 17	8 51 22	92·2	15·18	87·9	D.	·63688	8·1227	8·1216	+·0011	8·1221		
„ 10	12 9	2·8425	0·86	90·3	+6·4	14·87	87·0	17 26 50	8 52 10	91·3	14·70	87·2	V. G. G.	·63713	8·1184	8·1169	+·0015	8·1176		
„ „	15 19	2·8433	0·85	90·0	„	14·01	88·3	17 27 22	8 52 25	92·4	14·34	88·1	V. G. G.	·63740	8·1128	8·1117	+·0011	8·1122		
„ 17	12 23	2·8409	0·79	90·0	+8·1	15·81	86·4	17 26 9	8 51 43	90·1	15·68	86·8	D.	·63721	8·1266	8·1261	+·0005	8·1263		
„ „	16 7	2·8418	0·83	88·4	„	14·66	87·8	17 26 48	8 52 6	89·8	14·98	87·6	D.	·63728	8·1204	8·1195	+·0009	8·1199	8·1236	3·7456
„ 25	12 12	2·8412	0·86	92·2	+7·2	15·60	88·1	17 24 25	8 50 55	93·0	15·57	88·5	V. G. G.	·63704	8·1313	8·1304	+·0009	8·1308		
„ „	15 17	2·8423	0·84	92·0	„	14·46	89·6	17 25 35	8 51 32	93·6	14·73	89·1	V. G. G.	·63726	8·1231	8·1218	+·0013	8·1224		
„ 31	12 10	2·8407	0·81	89·9	+7·8	15·90	85·8	17 24 34	8 51 6	90·7	15·73	86·1	D.	·63684	8·1322	8·1306	+·0016	8·1314		
„ „	15 50	2·8424	0·84	89·7	„	15·07	86·7	17 25 20	8 51 27	90·5	15·30	86·6	D.	·63681	8·1246	8·1229	+·0017	8·1237		
June 7	12 17	2·8424	0·83	90·7	+6·0	15·07	87·8	17 25 55	8 51 45	90·8	14·88	88·0	V. G. G.	·63688	8·1229	8·1212	+·0017	8·1220		
„ „	15 13	2·8435	0·85	90·4	„	14·16	88·6	17 26 37	8 52 5	91·6	14·59	88·4	V. G. G.	·63713	8·1160	8·1143	+·0017	8·1151		
„ 14	12 12	2·8402	0·85	88·1	+8·3	16·19	84·1	17 25 45	8 51 40	88·7	15·94	84·6	V. G. G.	·63702	8·1296	8·1281	+·0015	8·1288		
„ „	15 19	2·8423	0·84	86·1	„	14·88	84·9	17 26 25	8 52 0	89·0	15·32	85·0	V. G. G.	·63693	8·1191	8·1175	+·0016	8·1183		
„ 21	12 13	2·8396	0·71	82·5	+7·7	16·10	81·4	17 28 15	8 52 50	81·9	16·00	81·4	G. S. J.	·63703	8·1236	8·1225	+·0011	8·1230	8·1220	3·7449
„ „	15 19	2·8411	0·67	80·8	„	15·07	81·1	17 29 30	8 53 24	80·9	15·42	81·2	G. S. J.	·63710	8·1141	8·1133	+·0008	8·1137		
„ 28	12 18	2·8398	0·63	87·0	+5·7	16·23	84·0	17 25 45	8 51 30	87·1	16·05	84·4	G. S. J.	·63690	8·1313	8·1309	+·0004	8·1311		
„ „	15 17	2·8416	0·59	87·2	„	15·39	85·0	17 26 3	8 51 42	88·0	15·69	84·9	G. S. J.	·63690	8·1247	8·1240	+·0007	8·1243		
July 5	12 9	2·8406	0·64	86·1	+8·3	16·40	82·7	17 26 7	8 51 45	85·2	16·16	83·2	V. G. G.	·63665	8·1291	8·1281	+·0010	8·1286		
„ „	15 17	2·8411	0·66	81·0	„	15·35	82·3	17 28 25	8 52 46	83·3	15·82	82·9	V. G. G.	·63703	8·1161	8·1163	−·0002	8·1162		
„ 12	12 12	2·8410	0·62	88·0	+6·5	15·84	84·3	17 26 5	8 51 40	88·3	15·74	84·6	D.	·63693	8·1266	8·1262	+·0004	8·1264		
„ „	15 19	2·8421	0·68	86·9	„	15·09	85·4	17 26 17	8 51 47	88·9	15·41	85·1	D.	·63685	8·1212	8·1206	+·0006	8·1209		
„ 19	12 9	2·8415	0·61	87·0	+7·3	15·42	84·2	17 26 40	8 52 0	86·5	15·36	84·5	V. G. G.	·63682	8·1249	8·1233	+·0007	8·1236	8·1215	3·7447
„ „	15 18	2·8420	0·66	83·5	„	14·79	84·2	17 27 30	8 52 22	86·1	14·99	84·5	V. G. G.	·63682	8·1167	8·1163	+·0004	8·1165		
„ 26	12 10	2·8417	0·68	88·0	+8·0	15·20	84·0	17 26 52	8 52 5	87·9	15·24	84·4	D.	·63706	8·1221	8·1214	+·0007	8·1217		
„ „	15 22	2·8425	0·66	87·8	„	14·75	85·0	17 27 15	8 52 15	88·0	15·01	84·9	D.	·63704	8·1182	8·1176	+·0006	8·1179		

August	2	12	9	2·8418	0·61	85·2	+8·1	15·66	82·5	17	26	48	8	52	2	85·4	15·66	82·9	V. G. G.	·63663	8·1221	8·1218	+·0003	8·1219		
	,,	,,	15	13	2·8425	0·64	86·3	,,	15·19	83·9	17	26	55	8	52	5	86·2	15·50	83·7	V. G. G.	·63675	8·1199	8·1193	+·0006	8·1196		
	,,	9	12	40	2·8428	0·67	83·3	+8·2	15·09	81·8	17	28	22	8	52	44	84·2	14·98	81·9	D.	·63653	8·1126	8·1128	−·0002	8·1127		
	,,	,,	15	35	2·8431	0·64	83·4	,,	14·69	82·6	17	28	27	8	52	47	85·1	14·86	82·4	D.	·63671	8·1109	8·1109	·0000	8·1109		
	,,	16	12	14	2·8409	0·61	83·1	+8·7	15·87	81·0	17	27	55	8	52	30	82·6	15·84	81·0	V. G. G.	·63675	8·1212	8·1214	−·0002	8·1213		
	,,	,,	15	25	2·8419	0·64	83·4	,,	15·20	81·5	17	27	32	8	52	17	84·1	15·52	81·4	V. G. G.	·63669	8·1186	8·1190	−·0004	8·1188	8·1181	3·7431
	,,	23	12	24	2·8414	0·58	86·4	+9·6	15·34	83·3	17	27	17	8	52	11	86·9	15·11	83·7	D.	·63693	8·1212	8·1214	−·0002	8·1213		
	,,	,,	15	44	2·8429	0·57	85·0	,,	14·48	83·9	17	27	57	8	52	35	87·0	14·67	84·0	D.	·63691	8·1132	8·1128	+·0004	8·1130		
	,,	30	12	6	2·8413	0·59	86·3	+8·6	15·74	83·0	17	26	30	8	51	50	86·3	15·77	83·2	V. G. G.	·63678	8·1247	8·1246	+·0001	8·1246		
	,,	,,	15	21	2·8425	0·59	84·0	,,	15·12	83·4	17	27	22	8	52	13	86·0	15·46	83·4	V. G. G.	·63672	8·1163	8·1167	−·0004	8·1165		
Sept.	6	13	42	2·8430	0·65	84·3	+8·3	14·82	82·0	17	28	40	8	52	55	84·7	14·82	82·2	D.	·63677	8·1115	8·1113	+·0002	8·1114		
	,,	,,	15	50	2·8433	0·64	83·6	,,	14·47	82·4	17	29	2	8	53	7	84·4	14·63	82·3	D.	·63681	8·1090	8·1087	+·0003	8·1088		
	,,	13	12	16	2·8413	0·62	86·4	+9·6	15·87	83·0	17	25	32	8	51	20	86·7	15·90	83·5	V. G. G.	·63655	8·1281	8·1281	·0000	8·1281		
	,,	,,	15	19	2·8426	0·63	85·9	,,	14·73	84·1	17	26	43	8	51	55	87·4	15·25	84·1	V. G. G.	·63682	8·1190	8·1190	·0000	8·1190		
	,,	20	12	32	2·8417	0·56	86·0	+9·3	15·71	82·1	17	26	55	8	52	2	85·0	15·38	82·7	D.	·63656	8·1233	8·1231	+·0002	8·1232	8·1164	3·7423
	,,	,,	15	55	2·8425	0·64	85·1	,,	14·81	83·2	17	27	10	8	52	12	86·1	14·93	83·0	D.	·63663	8·1180	8·1176	+·0004	8·1178		
	,,	27	12	13	2·8435	0·61	87·6	+8·5	14·39	83·2	17	28	17	8	52	47	87·0	14·44	83·5	V. G. G.	·63700	8·1124	8·1117	+·0007	8·1120		
	,,	,,	15	20	2·8437	0·59	87·0	,,	14·18	84·0	17	28	10	8	52	42	87·9	14·40	84·1	V. G. G.	·63700	8·1109	8·1105	+·0004	8·1107		
Oct.	4	12	11	2·8424	0·53	86·0	+9·8	14·79	83·7	17	27	25	8	52	22	86·3	14·76	83·9	D.	·63680	8·1180	8·1175	+·0005	8·1177		
	,,	,,	15	39	2·8433	0·59	85·7	,,	14·30	84·5	17	27	35	8	52	27	86·8	14·53	84·4	D.	·63677	8·1143	8·1135	+·0008	8·1139		
	,,	11	12	12	2·8428	0·53	90·4	+5·2	14·77	86·9	17	26	35	8	51	55	90·1	14·51	87·3	V. G. G.	·63688	8·1201	8·1195	+·0006	8·1198		
	,,	,,	15	19	2·8436	0·57	90·0	,,	13·86	88·6	17	26	42	8	52	0	90·6	14·01	88·1	V. G. G.	·63688	8·1163	8·1158	+·0005	8·1160		
	,,	18	11	58	2·8421	0·58	88·2	+11·9	15·29	84·5	17	26	25	8	51	55	87·7	15·15	84·7	D.	·63680	8·1236	8·1225	+·0011	8·1230	8·1175	3·7428
	,,	,,	15	35	2·8424	0·58	85·8	,,	14·72	85·0	17	27	0	8	52	15	87·8	14·85	85·0	D.	·63687	8·1182	8·1167	+·0015	8·1174		
	,,	25	12	13	2·8420	0·57	87·6	+12·2	15·67	83·0	17	26	45	8	52	7	87·3	15·32	83·2	V. G. G.	·63677	8·1223	8·1212	+·0011	8·1217		
	,,	,,	15	18	2·8438	0·57	88·0	,,	14·30	85·5	17	28	5	8	52	45	88·8	14·46	84·4	V. G. G.	·63702	8·1113	8·1102	+·0011	8·1107		
Nov.	1	12	15	2·8421	0·67	88·5	+12·3	15·49	83·9	17	26	15	8	51	48	88·2	15·24	84·2	D.	·63675	8·1238	8·1231	+·0007	8·1234		
	,,	,,	15	39	2·8438	0·66	87·1	,,	14·20	85·9	17	27	52	8	52	40	88·8	14·49	85·5	D.	·63700	8·1111	8·1100	+·0011	8·1105		
	,,	8	12	11	2·8410	0·69	88·5	+13·2	16·11	83·6	17	26	10	8	51	47	88·6	15·80	84·3	V. G. G.	·63700	8·1272	8·1261	+·0011	8·1266		
	,,	,,	15	16	2·8424	0·67	84·5	,,	14·87	85·1	17	28	5	8	52	45	87·4	14·92	85·1	V. G. G.	·63702	8·1133	8·1122	+·0011	8·1127		
	,,	15	12	12	2·8421	0·64	87·7	+11·5	15·39	86·0	17	27	5	8	52	15	87·9	15·19	86·5	D.	·63696	8·1203	8·1191	+·0012	8·1197		
	,,	,,	15	5	2·8427	0·70	86·0	,,	14·80	85·6	17	27	22	8	52	27	87·6	14·92	86·3	D.	·63696	8·1161	8·1147	+·0014	8·1154	8·1182	3·7431
	,,	22	12	19	2·8410	0·64	86·7	+10·3	16·39	82·7	17	26	33	8	52	1	85·4	15·99	82·9	V. G. G.	·63668	8·1268	8·1255	+·0013	8·1261		
	,,	,,	15	22	2·8418	0·67	83·2	,,	15·45	83·0	17	26	50	8	52	7	85·8	15·66	83·1	V. G. G.	·63665	8·1201	8·1190	+·0011	8·1195		
	,,	29	12	49	2·8436	0·55	90·1	+9·0	15·07	84·5	17	26	12	8	51	45	89·8	14·96	84·9	D.	·63666	8·1195	8·1190	+·0005	8·1192		
	,,	,,	15	55	2·8451	0·60	88·0	,,	13·90	86·2	17	27	27	8	52	17	89·6	14·44	85·7	D.	·63675	8·1089	8·1089	·0000	8·1089		
Dec.	6	12	23	2·8421	0·65	85·4	+11·4	15·82	81·9	17	27	2	8	52	7	85·9	15·71	82·6	V. G. G.	·63666	8·1203	8·1201	+·0002	8·1202		
	,,	,,	15	13	2·8437	0·61	86·5	,,	14·99	84·0	17	27	20	8	52	16	87·3	15·35	83·1	V. G. G.	·63669	8·1145	8·1141	+·0004	8·1143		
	,,	13	12	12	2·8419	0·66	86·0	+12·6	16·20	80·7	17	27	9	8	52	9	85·6	16·12	80·9	V. G. G.	·63672	8·1212	8·1212	·0000	8·1212		
	,,	,,	15	14	2·8426	0·68	83·8	,,	15·49	82·4	17	27	15	8	52	12	86·7	15·80	81·7	V. G. G.	·63665	8·1158	8·1158	·0000	8·1158		
	,,	20	12	28	2·8404	0·66	85·0	+14·0	17·02	80·3	17	26	31	8	51	55	85·2	16·64	80·8	D.	·63669	8·1276	8·1268	+·0008	8·1272	8·1179	3·7430
	,,	,,	15	39	2·8421	0·70	83·0	,,	15·78	83·1	17	27	15	8	52	19	84·9	15·99	82·4	D.	·63658	8·1184	8·1175	+·0009	8·1179		
	,,	27	12	18	2·8426	0·66	84·4	+13·1	16·26	79·7	17	28	2	8	52	42	84·0	15·97	80·2	V. G. G.	·63656	8·1161	8·1152	+·0009	8·1156		
	,,	,,	15	22	2·8437	0·68	83·8	,,	14·99	82·0	17	28	12	8	52	47	84·7	15·40	81·1	V. G. G.	·63662	8·1113	8·1104	+·0009	8·1108		

The mean value of the Horizonal Force for the year 1893 = 8·1194 | 3·7437

Absolute Magnetical Observations.—Table II.

Observations of Absolute Declination.

1893.

1893. Date.	Bombay Civil Time.	Mean Readings. Collimator Magnet. Scale apparently Erect.	Collimator Magnet. Scale apparently Inverted.	Horizontal Circle with Telescope pointed to. Scale of Collimator Magnet.	Horizontal Circle with Telescope pointed to. Tárdeo Chimney.	Torsion. Mean.	Torsion. Effect of 90°.	Observer.	Corresponding Reading of large Declination Magnetometer.	Absolute Easterly Declination corrected for Torsion.	Monthly Mean. Corresponding Reading of large Declination Magnetometer.	Monthly Mean. Absolute Easterly Declination.
1	2	3	4	5	6	7	8	9	10	11	12	13
	h. m.	Sc. div.	Sc. div.	° ′ ″	° ′ ″		Sc. div.		Sc. div.	° ′ ″	Sc. div.	° ′ ″
JAN. 5	11 27	+1·52	+1·60	17 6 10	196 50 15	0		V.G.G.	34·83	0 42 15		
„ 13	11 26	+1·51	+1·71	17 6 50	196 51 5	0		D.	34·79	0 41 57	34·80	0 42 2
„ 19	11 27	+1·56	+1·62	17 7 0	196 51 30	0		V.G.G.	34·78	0 41 52		
„ 26	11 20	+1·51	+1·67	17 7 10	196 51 20	0		D.	34·80	0 42 5		
FEB. 2	11 32	+1·51	+1·60	17 4 45	196 50 55	0		V.G.G.	34·53	0 40 10		
„ 9	11 27	+1·51	+1·62	17 7 30	196 51 25	0		D.	34·88	0 42 24	34·72	0 41 25
„ 16	11 32	+1·51	+1·77	17 7 10	196 51 22	0		V.G.G.	34·79	0 41 56		
„ 23	11 30	+1·49	+1·80	17 6 20	196 51 15	0		D.	34·68	0 41 10		
MARCH 2	11 55	+1·49	+1·84	17 4 25	196 51 15	0		D.	34·38	0 39 13		
„ 9	11 24	+1·51	+1·64	17 7 35	196 51 30	0		D.	34·87	0 42 23		
„ 16	11 22	+1·50	+1·67	17 6 15	196 50 35	0		V.G.G.	34·79	0 41 55	34·68	0 41 13
„ 23	11 30	+1·47	+1·66	17 5 40	196 50 30	0		D.	34·70	0 41 24		
„ 30	11 40	+1·50	+1·72	17 6 22	196 51 25	0		D.	34·65	0 41 8		
APRIL 6	11 31	+1·52	+1·60	17 5 20	196 50 22	0		D.	34·67	0 41 18		
„ 13	11 23	+1·47	+1·76	17 4 55	196 50 20	0		G.S.J.	34·56	0 40 42	34·63	0 41 8
„ 20	11 32	+1·51	+1·60	17 5 35	196 50 10	10 W	0·69	D.	34·76	0 41 56		
„ 27	11 26	+1·52	+1·67	17 4 40	196 50 20	0		V.G.G.	34·55	0 40 36		
MAY 4	11 26	+1·50	+1·67	17 4 25	196 51 30	0		D.	34·30	0 39 10		
„ 11	11 31	+1·56	+1·54	17 4 0	196 51 0	0		V.G.G.	34·34	0 39 27	34·32	0 39 19
„ 18	11 13	+1·54	+1·71	17 3 35	196 51 15	0		D.	34·23	0 38 35		
„ 26	11 27	+1·50	+1·66	17 5 0	196 51 12	0		V.G.G.	34·43	0 40 3		
JUNE 1	11 18	+1·51	+1·74	17 4 20	196 50 50	0		D.	34·41	0 39 41		
„ 8	11 30	+1·56	+1·59	17 3 0	196 50 20	0		V.G.G.	34·31	0 39 5		
„ 15	11 33	+1·52	+1·71	17 5 30	196 51 15	0		V.G.G.	34·54	0 40 29	34·40	0 39 34
„ 22	11 29	+1·46	+1·77	17 3 50	196 50 5	0		G.S.J.	34·46	0 39 50		
„ 29	11 24	+1·55	+1·54	17 2 55	196 50 35	0		G.S.J.	34·29	0 38 47		
JULY 6	11 28	+1·52	+1·62	17 4 15	196 50 30	0		V.G.G.	34·49	0 40 4		
„ 13	11 25	+1·52	+1·65	17 2 20	196 50 35	0		D.	34·20	0 38 3		
„ 20	11 32	+1·51	+1·67	17 6 25	196 51 0	0		V.G.G.	34·73	0 41 40	34·35	0 39 7
„ 27	11 24	+1·49	+1·77	17 1 15	196 50 40	0		D.	34·00	0 36 42		
AUG. 3	11 29	+1·51	+1·64	17 2 0	196 50 20	0		V.G.G.	34·20	0 37 58		
„ 10	11 19	+1·36	+2·14	17 3 25	196 50 55	10 W	0·89	D.	34·27	0 38 16		
„ 17	11 21	+1·49	+1·72	17 4 0	196 51 2	0		V.G.G.	34·39	0 39 9	34·26	0 38 15
„ 24	11 22	+1·52	+1·64	17 2 30	196 50 30	0		D.	34·28	0 38 18		
„ 31	11 22	+1·47	+1·67	17 2 0	196 50 40	0		V.G.G.	34·17	0 37 32		
SEPT. 7	11 33	+1·42	+1·67	17 1 30	196 50 45	0		D.	34·87	0 36 54		
„ 15	11 34	+1·49	+1·71	17 3 5	196 50 50	0		V.G.G.	34·27	0 38 26		
„ 21	11 26	+1·49	+1·70	17 4 15	196 50 55	10 E	0·64	D.	34·39	0 39 22	34·28	0 38 32
„ 28	11 25	+1·49	+1·71	17 4 10	196 50 55	0		V.G.G.	34·38	0 39 26		
OCT. 5	11 30	+1·49	+1·82	17 6 0	196 51 25	0		D.	34·54	0 40 39		
„ 12	11 26	+1·47	+1·71	17 5 45	196 51 20	0		V.G.G.	34·52	0 40 34		
„ 20	11 31	+1·60	+1·65	17 3 52	196 50 55	0		D.	34·33	0 39 20	34·46	0 40 12
„ 26	11 31	+1·50	+1·62	17 5 0	196 51 10	10 W	0·59	V.G.G.	34·46	0 40 17		
NOV. 2	11 20	+1·50	+1·49	17 5 52	196 50 55	10 W	0·60	D.	34·67	0 41 32		
„ 10	11 27	+1·50	+1·60	17 6 50	196 51 30	0		V.G.G.	34·68	0 41 39		
„ 16	11 28	+1·51	+1·62	17 5 50	196 51 10	0		D.	34·57	0 40 59	34·65	0 41 27
„ 23	11 34	+1·51	+1·60	17 6 20	196 51 20	0		V.G.G.	34·63	0 41 20		
„ 30	11 51	+1·51	+1·61	17 6 35	196 51 7	0		D.	34·69	0 41 47		
DEC. 7	11 27	+1·50	+1·64	17 7 0	196 51 30	0		V.G.G.	34·69	0 41 46		
„ 14	11 26	+1·59	+1·49	17 6 0	196 51 40	0		V.G.G.	34·57	0 40 53	34·67	0 41 29
„ 21	11 22	+1·59	+1·45	17 6 35	196 51 32	0		D.	34·71	0 41 39		
„ 28	11 29	+1·52	+1·60	17 7 0	196 51 40	0		V.G.G.	34·72	0 41 40		

The Mean Declination for the year 1893 = 0 40 19

Absolute Magnetical Observations.—Table III.

OBSERVATIONS OF INCLINATION, 1893.

Taken with Barrow's Dip Circle; with Microscopes, No. 49 and two 3½-inch Needles, Nos. 1 and 2, by Dover, Charlton.

1893. Date.	Bombay Civil Time (0 to 24 hours). At commencement.	At conclusion.	Observer.	Needle marked.	End of Needle Dipping. A. Face of Circle. East.	A. Face of Circle. West.	B. Face of Circle. East.	B. Face of Circle. West.	Mean Dip.	Monthly Mean for each Needle.	Monthly Mean.
	h. m.	h. m.			° ′	° ′	° ′	° ′	° ′		° ′
JAN. 3	12 15	13 40	V.G.G.	1	20 37·6	21 25·0	19 47·5	20 31·4	20 35·4		
„ 6	14 40	16 7	V.G.G.	2	20 29·5	21 14·6	19 58·0	20 43·9	20 36·5	No. 1	
„ 10	12 1	13 22	D.	2	20 32·0	21 8·7	20 3·5	20 37·0	20 35·3	20 35·4	
„ 13	14 52	16 17	D.	1	20 44·9	21 19·1	19 48·2	20 27·4	20 34·9		
„ 17	12 19	13 40	V.G.G.	1	20 44·2	21 18·2	19 50·2	20 29·5	20 35·5		20 35·2
„ 20	14 45	16 12	V.G.G.	2	20 29·9	21 9·6	19 55·5	20 39·6	20 33·6	No. 2	
„ 24	11 50	13 14	D.	2	20 32·0	21 8·7	20 0·9	20 36·5	20 34·3	20 34·9	
„ 27	14 59	16 22	D.	1	20 45·0	21 22·4	19 52·7	20 25·4	20 36·4		
„ 31	12 14	13 40	V.G.G.	1	20 44·1	21 22·1	19 46·5	20 27·2	20 35·0		
FEB. 3	14 44	16 9	V.G.G.	2	20 31·9	21 10·5	20 3·2	20 33·5	20 34·8		
„ 7	12 7	13 34	D.	2	20 33·5	21 11·1	20 3·9	20 28·7	20 34·3	No. 1	
„ 10	15 0	16 25	D.	1	20 46·2	21 21·7	19 51·5	20 23·2	20 35·6	20 35·5	
„ 13	12 22	13 45	V.G.G.	1	20 43·6	21 18·1	19 55·6	20 28·4	20 36·4		
„ 17	14 41	16 2	V.G.G.	2	20 35·9	21 10·6	20 3·6	20 29·4	20 34·9		20 34·9
„ 21	12 13	13 37	D.	2	20 30·4	21 5·4	20 6·4	20 32·0	20 33·5	No. 2	
„ 24	14 47	16 12	D.	1	20 41·7	21 11·9	19 56·4	20 30·6	20 35·1	20 34·4	
„ 28	12 21	13 44	V.G.G.	1	20 40·4	21 10·7	19 53·9	20 35·2	20 35·0		
MAR. 4	14 44	16 10	V.G.G.	2	20 34·4	21 7·4	20 1·5	20 32·5	20 33·9		
„ 7	12 16	13 38	D.	2	20 28·5	21 12·2	19 58·7	20 35·7	20 33·8	No. 1	
„ 10	14 33	15 56	D.	1	20 38·4	21 12·5	20 0·0	20 26·5	20 34·3		
„ 14	12 11	13 40	V.G.G.	1	20 43·4	21 10·7	20 0·7	20 23·6	20 34·6	20 34·7	
„ 17	14 40	16 12	V.G.G.	2	20 36·2	21 9·6	19 55·0	20 35·0	20 33·9		20 33·9
„ 21	12 20	13 43	D.	2	20 30·0	21 1·4	20 6·1	20 33·9	20 32·8	No. 2	
„ 24	15 2	16 23	D.	1	20 40·5	21 15·0	20 3·6	20 23·2	20 35·6	20 33·3	
„ 28	12 23	13 53	G.S.J.	1	20 47·1	21 18·5	20 0·8	20 11·7	20 34·5		
„ 31	15 21	16 43	G.S.J.	2	20 30·9	21 7·6	19 58·0	20 31·2	20 31·9		
APRIL 4	12 48	14 9	D.	2	20 26·5	21 6·4	19 58·5	20 35·2	20 31·6	No. 1	
„ 7	15 41	17 11	D.	1	20 43·7	21 16·7	20 2·2	20 16·5	20 34·8	20 35·2	
„ 11	12 24	13 44	G.S.J.	1	20 44·6	21 19·5	19 56·1	20 23·6	20 35·9		
„ 14	15 18	16 36	G.S.J.	2	20 31·4	21 9·4	19 54·4	20 41·0	20 34·0		20 34·8
„ 18	12 13	13 42	D.	2	20 41·7	21 10·2	19 57·0	20 37·5	20 36·6	No. 2	
„ 21	14 52	16 17	D.	1	20 41·5	21 21·5	19 56·2	20 22·9	20 35·5	20 34·4	
„ 25	12 30	13 49	G.S.J.	1	20 41·0	21 16·7	19 56·9	20 23·9	20 34·6		
„ 28	14 46	16 15	V.G.G.	2	20 29·5	21 15·2	19 57·6	20 39·5	20 35·4		

1893. Date.	Bombay Civil Time (0 to 24 hours). At commencement.	At conclusion.	Observer.	Needle marked.	End of Needle Dipping. A. Face of Circle. East.	A. Face of Circle. West.	B. Face of Circle. East.	B. Face of Circle. West.	Mean Dip.	Monthly Mean for each Needle.	Monthly Mean.
	h. m.	h. m.			° ′	° ′	° ′	° ′	° ′		
MAY 2	11 53	13 17	D.	2	20 28·2	21 6·2	20 8·7	20 36·7	20 34·9		
„ 5	15 17	16 42	D.	1	20 41·0	21 19·9	19 54·5	20 24·5	20 35·0	No. 1	
„ 9	12 17	13 40	V.G.G.	1	20 46·6	21 20·1	19 51·7	20 22·9	20 35·3	20 35·4	
„ 12	14 42	16 5	V.G.G.	2	20 30·7	21 11·7	19 56·7	20 41·1	20 35·0		
„ 16	12 12	13 35	D.	2	20 32·2	21 11·7	20 0·5	20 38·2	20 35·6		20 35·4
„ 19	15 4	16 28	D.	1	20 45·7	21 20·1	19 58·9	20 18·7	20 35·8		
„ 23	12 11	13 37	V.G.G.	1	20 45·4	21 21·2	19 58·7	20 17·1	20 35·6	No. 2	
„ 26	14 45	16 8	V.G.G.	2	20 32·7	21 10·4	19 58·6	20 39·0	20 35·2	20 35·5	
„ 30	12 5	13 34	D.	2	20 31·0	21 11·2	20 6·5	20 37·7	20 36·6		
JUNE 2	14 50	16 14	D.	1	20 46·4	21 19·4	19 57·7	20 24·0	20 36·9		
„ 6	12 10	13 35	V.G.G.	1	20 43·1	21 19·9	20 0·0	20 27·5	20 37·6	No. 1	
„ 9	14 43	16 10	V.G.G.	2	20 34·2	21 9·7	19 58·2	20 40·4	20 35·6	20 36·2	
„ 13	11 56	13 22	D.	2	20 29·8	21 12·2	19 59·3	20 40·9	20 35·5		
„ 16	14 45	16 12	V.G.G.	1	20 46·2	21 20·2	19 58·2	20 16·6	20 35·3		20 36·1
„ 20	12 28	13 58	V.G.G.	1	20 44·2	21 18·7	19 58·7	20 22·0	20 35·9	No. 2	
„ 23	14 50	16 8	G.S.J.	2	20 40·0	21 17·1	19 53·4	20 38·5	20 37·2	20 35·9	
„ 27	12 24	13 49	G.S.J.	2	20 36·0	21 11·6	19 55·7	20 38·2	20 35·4		
„ 30	14 50	16 11	G.S.J.	1	20 44·4	21 31·2	19 46·1	20 18·6	20 35·1		
JULY 4	12 15	13 38	V.G.G.	1	20 43·6	21 27·0	19 50·7	20 21·6	20 35·7	No. 1	
„ 7	14 42	16 5	V.G.G.	2	20 35·2	21 12·7	19 55·1	20 40·7	20 35·9	20 35·5	
„ 11	12 3	13 26	D.	2	20 36·7	21 14·2	19 53·6	20 39·5	20 36·0		
„ 14	14 57	16 22	D.	1	20 42·5	21 27·7	19 49·0	20 26·0	20 36·3		20 35·8
„ 18	12 23	13 45	V.G.G.	1	20 41·2	21 26·2	19 52·0	20 23·6	20 35·7	No. 2	
„ 21	14 38	16 4	V.G.G.	2	20 34·0	21 17·0	19 55·4	20 41·7	20 37·0	20 36·1	
„ 25	12 38	14 3	D.	2	20 30·6	21 8·0	20 0·2	20 43·4	20 35·5		
„ 28	14 38	16 3	D.	1	20 37·4	21 22·7	19 51·5	20 25·5	20 34·3		
AUG. 1	12 25	13 55	V.G.G.	1	20 41·0	21 16·2	19 49·7	20 23·5	20 32·6		
„ 4	14 44	16 10	V.G.G.	2	20 29·9	21 9·9	19 58·0	20 42·7	20 35·1	No. 1	
„ 8	12 8	13 33	D.	2	20 28·5	21 2·9	20 3·2	20 38·0	20 33·1	20 32·8	
„ 11	15 2	16 26	D.	1	20 43·7	21 17·0	19 49·7	20 17·6	20 32·0		
„ 15	12 17	13 43	V.G.G.	1	20 44·7	21 18·7	19 49·5	20 17·7	20 32·6		20 33·4
„ 18	14 44	16 7	V.G.G.	2	20 29·7	21 1·0	20 5·1	20 38·5	20 33·6	No. 2	
„ 22	12 7	13 29	D.	2	20 31·5	21 9·6	20 3·7	20 33·5	20 34·6	20 34·1	
„ 25	15 2	16 25	D.	1	20 48·1	21 15·0	19 52·0	20 19·0	20 33·5		
„ 29	12 25	13 45	V.G.G.	1	20 46·9	21 14·5	19 54·4	20 18·0	20 33·4		

1893. Date.	Bombay Civil Time (0 to 24 hours). At commencement.	At conclusion.	Observer.	Needle marked.	End of Needle Dipping. A. Face of Circle. East.	A. Face of Circle. West.	B. Face of Circle. East.	B. Face of Circle. West.	Mean Dip.	Monthly Mean for each Needle.	Monthly Mean.
	h. m.	h. m.			° ′	° ′	° ′	° ′	° ′		° ′
Sept. 1	14 47	16 7	V.G.G.	2	20 30·7	21 14·5	20 5·0	20 27·9	20 34·5		
„ 5	12 10	13 33	D.	2	20 33·0	21 9·6	20 5·6	20 29·4	20 34·4	No. 1	
„ 8	15 10	16 36	D.	1	20 45·7	21 19·1	19 52·0	20 22·6	20 34·8	20 34·1	
„ 12	12 21	13 43	V.G.G.	1	20 41·9	21 18·7	19 53·5	20 21·6	20 33·9		
„ 15	14 45	16 10	V.G.G.	2	20 35·0	21 14·6	20 1·9	20 27·4	20 34·7		20 34·5
„ 19	12 5	13 26	D.	2	20 28·7	21 13·7	20 3·0	20 33·9	20 34·8	No. 2	
„ 22	15 6	16 30	D.	1	20 50·4	21 14·1	19 51·6	20 17·0	20 33·1	20 34·8	
„ 26	12 15	13 40	V.G.G.	1	20 47·4	21 17·0	19 54·7	20 19·4	20 34·6		
„ 29	14 40	16 5	V.G.G.	2	20 35·6	21 11.6	20 1·4	20 33·7	20 35·6		
Oct. 3	12 10	13 31	D.	2	20 30·2	21 13·9	20 7·7	20 29·1	20 35·2		
„ 6	14 54	16 15	D.	1	20 51·5	21 13·0	19 55·0	20 22·6	20 35·5	No. 1	
„ 10	12 18	13 43	V.G.G.	1	20 47·0	21 15·2	19 52·5	20 23·7	20 35·1	20 34·9	
„ 13	14 50	16 15	V.G.G.	2	20 32·7	21 16·9	19 53·6	20 32·7	20 34·0		
„ 17	12 2	13 29	D.	2	20 29·5	21 3·0	20 2·5	20 38·5	20 33·4		20 34·5
„ 20	14 43	16 9	D.	1	20 40·5	21 16·0	19 55·2	20 27·1	20 34·7	No. 2	
„ 24	12 20	13 45	V.G.G.	1	20 40·5	21 19·6	19 50·0	20 27·0	20 34·3	20 34·2	
„ 27	14 45	16 5	V.G.G.	2	20 29·5	21 16·0	19 56·0	20 35·0	20 34·1		
„ 31	12 1	13 26	D.	2	20 25·1	21 16·2	19 56·7	20 39·9	20 34·5		
Nov. 3	14 47	16 12	D.	1	20 38·6	21 16·5	19 49·5	20 31·9	20 34·1		
„ 6	12 22	13 42	V.G.G.	1	20 42·1	21 18·0	19 48·9	20 28·0	20 34·2	No. 1	
„ 10	14 47	16 12	V.G.G.	2	20 27·5	21 13·2	19 56·9	20 38·5	20 34·0	20 33·7	
„ 14	11 55	13 41	D.	2	20 28·5	21 13.1	19 59·0	20 38·6	20 34·8		20 35·6
„ 17	14 34	16 1	D.	1	20 44·5	21 15·5	19 48·0	20 24·1	20 33·0		
„ 21	12 21	13 43	V.G.G.	1	20 41·4	21 20·5	19 46·7	20 25·7	20 33·6	No 2	
„ 24	14 52	16 15	V.G.G.	2	20 30·5	21 9·2	20 0·2	20 32·9	20 33·2	20 37·6	
„ 28	12 10	13 54	V.N.	2	20 21·9	22 18·9	19 34·7	20 57·9	20 48·3		
Dec. 1	14 40	16 22	D.	1	20 42·3	21 24·6	19 57·2	20 29·4	20 38·4		
„ 5	12 56	15 4	V.G.G.	1	20 46·0	21 20·9	19 56·7	20 34·4	20 39·5	No. 1	
„ 8	14 50	16 16	V.G.G	2	20 32·5	21 13·1	19 53·4	20 36·4	20 33·8	20 38·6	
„ 12	12 26	13 50	V.G.G.	2	20 38·1	21 12·1	19 51·0	20 39·7	20 35·2		
„ 15	14 47	16 15	V.G.G.	1	20 46·6	21 19·1	19 59·4	20 31·2	20 39·1		20 37·1
„ 19	12 15	13 42	D.	1	20 41·0	21 21·4	20 0·5	20 32·1	20 38·7	No. 2	
„ 22	14 54	16 19	D.	2	20 37·6	21 16·2	19 53·6	20 39·4	20 36·7	20 35·4	
„ 26	12 23	13 50	V.G.G.	2	20 40·5	21 14·6	19 55·7	20 32·5	20 35·8		
„ 29	14 56	16 20	G.S.J.	1	20 48·6	21 14·7	20 5·2	20 20·0	20 37·1		

The Mean Dip for the year ... { With Needle No. 1 = 20 35·2 / With Needle No. 2 = 20 35·0 }

The Mean Dip for the year 1893 = 20 35·1

Absolute Magnetical Observations.—Table III *a*.

SUPPLEMENTARY OBSERVATIONS OF INCLINATION, 1893.

Taken with Barrow's Dip Circle, with Microscopes, No. 49 and two 3½-inch Needles, Nos. $\frac{1}{81}$ and $\frac{2}{81}$, by John Dover.

1893. Date.	Bombay Civil Time (0 to 24 hours). At commencement.	At conclusion.	Observer.	Needle marked.	End of Needle Dipping. A. Face of Circle. East.	A. Face of Circle. West.	B. Face of Circle. East.	B. Face of Circle. West.	Mean Dip.	Monthly Mean for each Needle.	Monthly Mean.
	h. m.	h. m.			° ′	° ′	° ′	° ′	° ′		
JAN. 3	11 23	14 34	V.G.G.	$\frac{1}{81}$	20 15·5	20 50·1	20 23·6	21 0·7	20 37·5		
„ 6	13 48	17 5	V.G.G.	$\frac{2}{81}$	20 16·1	21 1·9	20 14·7	20 43·6	20 34·1	No. $\frac{1}{81}$	
„ 10	11 4	14 13	D.	$\frac{2}{81}$	20 27·1	20 54·0	20 19·9	20 36·5	20 34·4		
„ 13	14 0	17 9	D.	$\frac{1}{81}$	20 19·5	20 53·4	20 19·9	20 52·2	20 36·2	20 36·6	
„ 17	11 25	14 33	V.G.G.	$\frac{1}{81}$	20 15·9	20 53·6	20 23·1	20 53·7	20 36·6		20 35·5
„ 20	13 52	17 7	V.G.G.	$\frac{2}{81}$	20 20·0	20 57·1	20 21·4	20 37·5	20 34·0	No. $\frac{2}{81}$	
„ 24	10 56	14 5	D.	$\frac{2}{81}$	20 18·2	20 57·1	20 27·6	20 33·2	20 34·0		
„ 27	14 2	17 13	D.	$\frac{1}{81}$	20 16·7	20 55·7	20 24·2	20 49·9	20 36·6	20 34·1	
„ 31	14 23	14 33	V.G.G.	$\frac{1}{81}$	20 26·2	20 53·6	20 21·6	20 42·9	20 36·1		
FEB. 3	13 51	17 4	V.G.G.	$\frac{2}{81}$	20 17·5	20 58·4	20 32·1	20 34·7	20 35·7		
„ 7	11 12	14 27	D.	$\frac{2}{81}$	20 17·4	20 56·1	20 32·4	20 32·5	20 34·6	No. $\frac{1}{81}$	
„ 10	14 8	17 17	D.	$\frac{1}{81}$	20 28·5	20 52·0	20 23·0	20 44·2	20 36·9		
„ 13	11 30	14 40	V.G.G.	$\frac{1}{81}$	20 26·5	20 54·0	20 26·1	20 44·6	20 37·8	20 30·6	
„ 17	13 48	17 0	V.G.G.	$\frac{2}{81}$	20 19·9	20 54·1	20 33·6	20 35·5	20 35·8		20 36·0
„ 21	11 20	14 28	D.	$\frac{2}{81}$	20 21·6	20 53·2	20 32·2	20 33·5	20 35·1	No. $\frac{2}{81}$	
„ 24	13 55	17 27	D.	$\frac{1}{81}$	20 26·9	20 50·5	20 23·5	20 44·1	20 36·2		
„ 28	11 25	14 37	V.G.G.	$\frac{1}{81}$	20 20·1	20 53·7	20 23·7	20 45·5	20 35·7	20 35·3	
MAR. 4	13 50	17 4	V.G.G.	$\frac{2}{81}$	20 16·6	20 54·5	20 31·5	20 37·1	20 34·9		
„ 7	11 21	14 32	D.	$\frac{2}{81}$	20 10·1	20 51·6	20 29·5	20 47·5	20 34·7	No. $\frac{1}{81}$	
„ 10	13 40	16 48	D.	$\frac{1}{81}$	20 23·0	20 46·2	20 28·0	20 43·6	20 35·2		
„ 14	11 20	14 35	V.G.G.	$\frac{1}{81}$	20 22·6	20 47·4	20 30·1	20 43·6	20 35·9	20 35·9	
„ 17	13 47	17 7	V.G.G.	$\frac{2}{81}$	20 16·4	20 51·4	20 33·6	20 39·6	20 35·2		20 34·9
„ 21	11 27	14 33	D.	$\frac{2}{81}$	20 24·2	20 47·8	20 18·7	20 44·2	20 33·7		
„ 24	14 10	17 14	D.	$\frac{1}{81}$	20 23·9	20 43·0	20 28·9	20 48·5	20 36·1	No. $\frac{2}{81}$	
„ 28	11 29	14 53	G.S.J.	$\frac{1}{81}$	20 24·6	20 43·4	20 25·2	20 53·0	20 36·5	20 34·0	
„ 31	14 29	17 39	G.S.J.	$\frac{2}{81}$	20 26·0	20 51·6	20 15·9	20 32·9	20 31·6		
APRIL 4	11 55	15 1	D.	$\frac{2}{81}$	20 21·6	20 52·4	20 13·2	20 41·0	20 32·0		
„ 7	14 43	18 3	D.	$\frac{1}{81}$	20 22·2	20 48·0	20 27·9	20 48·1	20 36·5	No. $\frac{1}{81}$	
„ 11	11 28	14 40	G.S.J.	$\frac{1}{81}$	20 21·5	20 46·9	20 22·7	20 54·6	20 36·4		
„ 14	13 58	17 33	G.S.J.	$\frac{2}{81}$	20 14·9	20 55·4	20 21·0	20 37·0	20 32·1	20 36·0	
„ 18	11 20	14 46	D.	$\frac{2}{81}$	20 18·2	20 54·0	20 22·4	20 39·0	20 33·4		20 34·2
„ 21	13 55	17 10	D.	$\frac{1}{81}$	20 17·4	20 50·1	20 27·7	20 50·1	20 36·3	No. $\frac{2}{81}$	
„ 25	11 35	14 48	G.S.J.	$\frac{1}{81}$	20 19·0	20 45·7	20 24·4	20 50·6	20 34·9		
„ 28	13 50	17 9	V.G.G.	$\frac{2}{81}$	20 10·2	20 57·0	20 23·4	20 37·1	20 31·9	20 32·3	

1893. Date.	Bombay Civil Time (0 to 24 hours). At commencement.		At conclusion.		Observer.	Needle marked.	End of Needle Dipping. A. Face of Circle. East.		End of Needle Dipping. A. Face of Circle. West.		End of Needle Dipping. B. Face of Circle. East.		End of Needle Dipping. B. Face of Circle. West.		Mean Dip.	Monthly Mean for each Needle.	Monthly Mean.
	h.	m.	h.	m.			°	′	°	′	°	′	°	′	°	′	
May 2	11	1	14	12	D.	2/81	20	13·5	20	55·7	20	16·3	20	41·9	20	31·8	
„ 5	14	22	17	35	D.	1/81	20	22·7	20	48·2	20	23·1	20	44·0	20	34·5	No. 1/81
„ 9	11	27	14	33	V.G.G.	1/81	20	17·7	20	46·7	20	26·2	20	47·5	20	34·5	20 ′ 34·3
„ 12	13	48	16	59	V.G.G.	2/81	20	9·4	20	59·9	20	15·4	20	45·0	20	32·4	
„ 16	11	19	14	29	D.	2/81	20	16·5	20	52·1	20	16·7	20	43·2	20	32·1	20 33·2
„ 19	14	13	17	20	D.	1/81	20	19·4	20	47·2	20	28·0	20	44·4	20	34·7	No. 2/81
„ 23	11	20	14	30	V.G.G.	1/81	20	18·2	20	44·9	20	25·9	20	45·4	20	33·6	20 ′ 32·4
„ 26	13	49	17	0	V.G.G.	2/81	20	15·1	20	56·9	20	16·4	20	41·5	20	32·5	
„ 30	11	10	14	28	D.	2/81	20	14·7	20	52·2	20	21·0	20	44·5	20	33·1	
June 2	13	57	17	9	D.	1/81	20	21·0	20	49·0	20	18·7	20	55·4	20	36·0	
„ 6	11	15	14	30	V.G.G.	1/81	20	20·4	20	49·2	20	24·2	20	53·1	20	36·7	No. 1/81
„ 9	13	50	17	2	V.G.G.	2/81	20	15·1	20	56·7	20	17·4	20	42·1	20	32·8	
„ 13	11	4	14	15	D.	2/81	20	17·2	20	45·4	20	17·9	20	48·1	20	32·1	20 ′ 36·1
„ 16	13	50	17	10	V.G.G.	1/81	20	20·7	20	46·4	20	23·6	20	50·1	20	35·2	20 34·5
„ 20	11	25	14	56	V.G.G.	1/81	20	16·7	20	50·4	20	24·2	20	52·0	20	35·8	No. 2/81
„ 23	13	58	17	5	G.S.J.	2/81	20	15·7	20	52·0	20	23·4	20	39·0	20	32·5	
„ 27	11	26	14	50	G.S.J.	2/81	20	32·6	20	48·4	20	9·2	20	41·5	20	32·9	20 ′ 32·6
„ 30	13	58	17	13	G.S.J.	1/81	20	24·2	20	48·1	20	21·5	20	52·5	20	36·6	
July 4	11	20	14	30	V.G.G.	1/81	20	24·9	20	50·2	20	20·9	20	54·7	20	37·7	
„ 7	13	48	16	59	V.G.G.	2/81	20	14·2	20	55·6	20	23·6	20	40·2	20	33·4	No. 1/81
„ 11	11	10	14	17	D.	2/81	20	24·4	20	57·1	20	16·0	20	35·5	20	33·2	
„ 14	14	5	17	15	B.	1/81	20	27·1	20	46·9	20	17·2	20	55·2	20	36·6	20 ′ 36·1
„ 18	11	30	14	35	V.G.G.	1/81	20	20·2	20	48·5	20	18·4	20	56·4	20	35·9	20 34·5
„ 21	13	40	17	0	V.G.G.	2/81	20	18·0	20	54·2	20	20·0	20	40·0	20	33·0	
„ 25	11	44	14	56	D.	2/81	20	21·9	20	53·5	20	17·5	20	33·9	20	31·7	No. 2/81
„ 28	13	47	16	57	D.	1/81	20	22·1	20	37·1	20	21·7	20	56·5	20	34·3	20 ′ 32·8
Aug. 1	11	30	14	45	V.G.G.	1/81	20	19·6	20	44·0	20	16·4	20	51·4	20	32·8	
„ 4	13	50	17	5	V.G.G.	2/81	20	15·1	20	55·9	20	19·0	20	33·4	20	30·8	
„ 8	11	15	14	25	D.	2/81	20	24·2	20	52·5	20	11·4	20	31·9	20	30·0	No. 1/81
„ 11	14	10	17	20	D.	1/81	20	17·5	20	44·5	20	22·9	20	48·7	20	33·4	20 ′ 31·7
„ 15	11	25	14	32	V.G.G.	1/81	20	18·0	20	44·2	20	25·0	20	49·6	20	34·2	20 32·1
„ 18	13	50	17	0	V.G.G.	2/81	20	16·1	20	52·7	20	16·4	20	35·6	20	30·2	
„ 22	11	13	14	22	D.	2/81	20	16·1	20	50·7	20	20·7	20	32·7	20	30·0	No. 2/81
„ 25	14	10	17	22	D.	1/81	20	24·2	20	46·3	20	21·9	20	43·5	20	34·0	20 ′ 30·2
„ 29	11	30	14	37	V.G.G.	1/81	20	22·2	20	42·6	20	27·0	20	43·7	20	33·9	

1893. Date.	Bombay Civil Time (0 to 24 hours). At commencement.	At conclusion.	Observer.	Needle marked.	End of Needle Dipping. A. Face of Circle. East.	A. West.	B. Face of Circle. East.	B. West.	Mean Dip.	Monthly Mean for each Needle.	Monthly Mean.
	h. m.	h. m.			° ′	° ′	° ′	° ′	° ′		
Sept. 1	13 50	17. 2	V.G.G.	$\frac{2}{81}$	20 20·5	20 48·4	20 18·2	20 36·9	20 31·0		
„ 5	11 17	14 25	D.	$\frac{2}{81}$	20 20·5	20 50·0	20 21·2	20 29·9	20 30·4	No. $\frac{1}{81}$	
„ 8	14 20	17 29	D.	$\frac{1}{81}$	20 24·0	20 49·0	20 27·7	20 41·0	20 35·4	20 35·3	
„ 12	11 25	14 33	V.G.G.	$\frac{1}{81}$	20 22·2	20 41·7	20 34·0	20 45·4	20 35·8		
„ 15	13 52	17 3	V.G.G.	$\frac{2}{81}$	20 16·5	20 53·4	20 18·6	20 38·1	20 31·6		20 32·8
„ 19	11 12	14 20	D.	$\frac{2}{81}$	20 20·9	20 46·0	20 22·5	20 32·0	20 30·3	No. $\frac{2}{81}$	
„ 22	14 15	17 22	D.	$\frac{1}{81}$	20 27·2	20 49·5	20 26·6	20 38·6	20 35·5	20 30·8	
„ 26	11 20	14 32	V.G.G.	$\frac{1}{81}$	20 22·4	20 51·9	20 27·5	20 37·1	20 34·7		
„ 29	13 47	17 0	V.G.G.	$\frac{2}{81}$	20 14·1	20 50·2	20 25·4	20 33·9	20 30·9		
Oct. 3	11 7	14 25	D.	$\frac{2}{81}$	20 17·4	20 44·4	20 30·7	20 27·2	20 29·9		
„ 6	14 2	17 8	D.	$\frac{1}{81}$	20 23·2	20 51·4	20 25·5	20 38·9	20 34·7	No. $\frac{1}{81}$	
„ 10	11 25	14 38	V.G.G.	$\frac{1}{81}$	20 21·1	20 49·1	20 24·4	20 40·7	20 33·8	20 33·5	
„ 13	13 52	17 7	V.G.G.	$\frac{2}{81}$	20 17·5	20 45·6	20 24·0	20 28·2	20 28·8		
„ 17	11 20	14 34	D.	$\frac{2}{81}$	20 23·1	20 42·2	20 19·5	20 32·1	20 29·2		20 31·5
„ 20	13 50	17 3	D.	$\frac{1}{81}$	20 17·5	20 44·0	20 29·0	20 42·2	20 33·2	No. $\frac{2}{81}$	
„ 24	11 28	14 37	V.G.G.	$\frac{1}{81}$	20 20·0	20 47·5	20 27·2	20 35·5	20 32·5	20 29·8	
„ 27	13 53	17 0	V.G.G.	$\frac{2}{81}$	20 14·4	20 46·1	20 27·6	20 33·5	20 30·4		
„ 31	11 8	14 20	D.	$\frac{2}{81}$	20 17·7	20 52·7	20 23·2	20 30·2	20 30·9		
Nov. 3	13 55	17 5	D.	$\frac{1}{81}$	20 16·7	20 48·9	20 30·5	20 32·0	20 32·0		
„ 6	11 27	14 40	V.G.G.	$\frac{1}{81}$	20 20·4	20 44·7	20 29·9	20 35·0	20 32·5	No. $\frac{1}{81}$	
„ 10	13 55	17 6	V.G.G.	$\frac{2}{81}$	20 18·4	20 49·9	20 20·0	20 33·2	20 30·4	20 32·2	
„ 14	11 3	14 36	D.	$\frac{2}{81}$	20 18·6	20 49·6	20 21·7	20 35·5	20 31·3		
„ 17	13 41	16 57	D.	$\frac{1}{81}$	20 21·0	20 44·7	20 26·0	20 35·5	20 31·8		20 32·3
„ 21	11 32	14 38	V.G.G.	$\frac{1}{81}$	20 15·5	20 46·5	20 32·7	20 35·6	20 32·6	No. $\frac{2}{81}$	
„ 24	13 55	17 7	V.G.G.	$\frac{2}{81}$	20 16·4	20 48·2	20 17·0	20 38·2	20 29·9	20 32·4	
„ 28	11 5	14 40	V.N.	$\frac{2}{81}$	20 10·0	21 14·6	19 57·6	21 10·6	20 38·2		
Dec. 1	13 25	18 2	D.	$\frac{1}{81}$	20 24·2	20 56·0	20 26·9	20 37·4	20 36·1		
„ 5	11 10	16 24	V.G.G.	$\frac{1}{81}$	20 25·2	20 44·1	20 25·4	20 53·7	20 37·1	No. $\frac{1}{81}$	
„ 8	13 51	17 8	V.G.G.	$\frac{2}{81}$	20 18·2	20 52·6	20 11·2	20 46·0	20 32·0	20 37·4	
„ 12	11 32	14 45	V.G.G.	$\frac{2}{81}$	20 13·1	20 55·7	20 18·5	20 47·5	20 33·7		
„ 15	13 49	17 10	V.G.G.	$\frac{1}{81}$	20 26·2	20 48·5	20 25·5	20 51·7	20 38·0		20 35·8
„ 19	11 20	14 36	D.	$\frac{1}{81}$	20 26·2	20 45·1	20 23·7	20 51·5	20 36·6	No. $\frac{2}{81}$	
„ 22	14 2	17 12	D.	$\frac{2}{81}$	20 16·6	20 52·1	20 24·7	20 45·9	20 34·8	20 33·7	
„ 26	11 30	14 39	V.G.G.	$\frac{2}{81}$	20 19·1	20 53·0	20 22·9	20 42·6	20 34·4		
„ 29	14 3	17 20	G.S.J.	$\frac{1}{81}$	20 36·0	20 47·2	20 21·2	20 52·2	20 39·1		

The Mean Dip for the year... { With Needle No. $\frac{1}{81}$ = 20 35·3 ; With Needle No. $\frac{2}{81}$ = 20 32·5

The Mean Dip for the year 1893 = 20 33·9

MAGNETICAL AND METEOROLOGICAL OBSERVATIONS

MADE AT THE

GOVERNMENT OBSERVATORY, BOMBAY,

1894.

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MAGNETICAL AND METEOROLOGICAL OBSERVATIONS

MADE AT THE

GOVERNMENT OBSERVATORY, BOMBAY,

IN THE YEAR 1894

UNDER THE DIRECTION OF

CHARLES CHAMBERS, Esq., F.R.S.,

AND

FREDERICK CHAMBERS, Esq.

Printed by Order of Her Majesty's Government.

Bombay:
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1895.

TABLE OF CONTENTS.

PAGE

INTRODUCTION TO THE METEOROLOGICAL AND MAGNETICAL OBSERVATIONS, 1894.

Thirty-third number of the series ... ... i.
Geographical position of Observatory ... ... id.
Local situation ... ... id.
Directorship of the Observatory ... ... id.
Observatory Establishment ... ... id.
System of observation and reduction and distribution of duties ... ... ii.
Eye-observations subsidiary to continuous registrations of automatic instruments ... iii.
Instruments and phenomena observed five times a day ... ... id.
Other routine operations ... ... iv.

REMARKS ON THE CONDITION AND ADJUSTMENTS OF THE INSTRUMENTS AND ON THE PROCESSES OF REDUCTION ... ... id.

I.—METEOROLOGICAL INSTRUMENTS, 1894.

BAROMETER, description of ... ... id.
Error in setting the zero point of the scale, and change of method of observation ... v.
Corrections applied to the observed readings ... ... vi.
Comparison with the Kew Standard Barometer ... ... id.

GROUND THERMOMETERS ... ... vii.
THE ROBINSON-BECKLEY ANEMOGRAPH, description of... ... ... id.
Tabulation of Anemograms ... ... viii.
Method of reduction ... ... id.
NEWMAN'S RAIN GAUGE ... ... ix.
BAROGRAPH AND THERMOGRAPH ... ... x.

PRESSURE OF VAPOUR.

Pressure of Vapour and additional capacity of the Air ... ... id.
Table I.—Regnault's values of the Pressure of Vapour at different Temperatures ... id.

SELF-REGISTERING RAIN GAUGE ... ... xi.
New syphon of modified form ... ... id.
Constants for converting syphon discharges into inches of rain-fall ... ... id.
Measurement and distribution of syphon discharges ... ... id.
Determination of scale of rain-fall ordinates ... ... xii.

DESCRIPTION OF THE TABLES OF METEOROLOGICAL RESULTS AND OF THE PROCESSES OF REDUCTION, 1894.

Barometric Pressure ... ... id.
Temperature of the Air, &c. ... ... id.
Monthly and annual range of variation of Meteorological Elements ... ... xiii.

NOTES ON INSTRUMENTAL CHANGES AND ON ALL IRREGULARITIES OR DEPARTURES FROM THE ROUTINE OF OBSERVATION OR REDUCTION, 1894.

Robinson-Beckley Anemograph ... ... id.
Barograph ... ... xiv.
Thermograph dry-bulb ... ... id.
Thermograph wet-bulb ... ... id.
Self-registering Rain Gauge ... ... id.

II.—MAGNETICAL INSTRUMENTS, 1894.

Kew Absolute Declinometer and Deflection and Vibration Apparatus ... ... id.
Kew Dip Circle ... ... xv.

Tables of Results derived from the Continuous Registrations of Automatic Meteorological Instruments and from Meteorological Observations, 1894.

	1894. Table.	Page.
Daily Means of: Barometric Pressure	I	2
Daily Means of: Temperature of the Air	II	3
Daily Means of: Pressure of Vapour	III	4
Daily Means of: Additional Capacity of the Air	IV	5
Individual observations in each Month of the Year, which showed the greatest and the least values of the following elements, *viz.*, Height of Barometer, corrected for Temperature; Temperature of Air; Pressure of Vapour; and Additional Capacity of Air	V	6
Daily: Total Fall of Rain (in inches) as measured by F. Chambers's Self-registering Gauge, the funnel of which is 28 feet above the ground	VI	7
Mean Velocities of the North or South and East or West Components of the Winds which blew on each Day of the Year	VII	8
Mean Velocity of the Wind, in miles per hour, without regard to the direction from which it blew for each day of Bombay Civil Time; also the Mean Monthly Velocity, and its Variation from the Mean of the Year	VIII	9
Sums of the Velocities, and the Mean Velocities, in miles per hour, of the Winds which blew in each Month, from each of the sixteen Principal Directions; and also the number of observations which those sums comprise; the latter numbers indicating the Relative Frequency of the same Wind (as to direction) in the several months, and of different Winds during the same month	IX	10

Tables of Results derived from the Meteorological Observations made daily at 6, 10, 14, 16 and 22 hours, 1894.

	1894. Table.	Page.
Monthly Mean Temperature of the Ground, and its Annual Variation, at the respective depths of 1, 9, 20, 60 and 132 inches below the surface	X	12
Extent of Cloudy Sky—mean of estimations made at 6, 10, 14, 16 and 22 hours daily, the whole sky being reckoned as 10	XI	13
Daily: Total Fall of Rain (in inches) as measured by Newman's Gauge, placed 4½ feet above the ground	XII	14
Five-Day Means, 1894	XIII	15

Tables of Results of Absolute Magnetical Observations, 1894.

	1894. Table.	Page.
Observations of Vibration and Deflection, taken with the Kew Unifilar Magnetometer (No. 23, by Elliot Brothers), for the determination of Absolute Horizontal Force	I	(3)
Observations of Absolute Declination	II	(6)
Observations of Inclination, taken with Barrow's Dip Circle, with Microscopes, No. 49 and two 3¼-inch Needles	III	(7)
Supplementary Observations of Inclination, taken with Barrow's Dip Circle, with Microscopes, No. 49 and two 3½-inch Needles	III *a*	(10)

INTRODUCTION

TO THE

METEOROLOGICAL AND MAGNETICAL OBSERVATIONS,

1894.

Of the series of books entitled "Bombay Magnetical and Meteorological Observations" the present one is the thirty-third, extending the record, which before embraced the years 1845 to 1893, up to 1894.

2. The latitude and longitude of the Colába Observatory are 18° 53′ 45″ North and 72° 48′ 56″ East respectively.

3. *Local situation.*—The Observatory is situated at the extremity of a narrow strip of land extending two miles to the south-westward of the Fort of Bombay and separating the harbour and Back Bay. Trap rock, which is very abundant in the ground near and on the surrounding sea-beach, crops up at many places through the red sandy soil which covers the greater part of the Observatory enclosure. During the rainy months of the year, the soil is overgrown with grass, which, however, is quickly burned up when the dry season comes round. The nearest elevated ground is Malabár Hill, which lies on the opposite side of Back Bay, at a distance of four miles, but that which subtends the largest vertical angle, as seen from the Magnetical and Meteorological Observatory, is the southern hill of the Island of Karanja, at a distance of about eight miles across the harbour. The altitude of the highest point of the latter is less than 1° 7′. An idea of the aspect and nature of the surrounding country, and of the exposure of the thermometer shed and anemograph, may be obtained by inspection of the photographs—forming a series of panoramic views all round the compass, together with some near views of the buildings and instruments—which accompanied the "Meteorology of the Bombay Presidency" published in 1878. In the same work will be found a plan of the grounds and buildings of the Observatory, and an index showing the names and uses of the several buildings, and the location of trees of large and small growth.

The buildings concerned with the production of the observations recorded herein are, (1) the Astronomical Observatory and the Anemometer Tower, with a western wing, the greater part of which serves as a computing room, whilst the remainder is partitioned off for a photographic operating room; (2) the Magnetical Observatory with the adjoining Electrometer Tower; (3) the underground Magnetograph room; and (4) the Thermograph Shed, enclosing the thermograph room; to which may be added the old thermometer shed.

4. *Directorship of the Observatory.*—The observations of the year 1894 were taken under the direction of Mr. Charles Chambers, F.R.S., except during the period May 19 to November 11, 1894, when the acting Directorship was held by Mr. Frederick Chambers.

5. *Observatory Establishment.*—In the Magnetical Department of the Observatory there are one First Assistant, one Second Assistant, three Observers and one Computer; and in the Astronomical Department one First Assistant and one Second Assistant. These several offices were filled, during the year 1894, in the manner exhibited in the following statement:—

Name of Officer.	Departme nt.	Name of Office.	Initial
Vináyak Náráyan Nene ...	Magnetical ...	First Assistant	V. N.
Ganesh Sadáshiv Joshí ...	Do. ...	Second Assistant .	G. S. J.
Shitárám Vithal Bendarkar ...	Do. ...	Observer	S.
Vithal Govind Ghánekar... ...	Do. ...	Do. ...	V. G. G.
Náráyen Sakhárám Kelkar ...	Do. ...	Do. ...	N.
Laxuman Balvant Cháphekar ...	Do. ...	Computer... ...	L.
Parsharám Laxuman Dátar ...	Astronomical ...	First Assistant ...	P.
Dámodar Wáman Sáthaye ...	Do. ...	Second Assistant .	D.

The initials marked in the last column are those which the respective observers attach to the several observations made by them.

Vacancies caused by the absence on leave of permanent employés were filled on different occasions by—

Bhálchandra Krishna Fagre (Initial B.C.)

6. *System of observation and reduction; and distribution of duties.*—The Astronomical Observatory is furnished with a transit instrument and a sidereal clock, which are used for the determination of local time, primarily for communication to the shipping in the Bombay harbour, and secondarily for communication, by comparison of chronometers three times a week, to the Magnetical and Meteorological Observatory.

Magnetical and meteorological observations are taken and entered in the registration forms every day, without exception, at the hours 6, 10, 14, 16 and 22,—the day commencing at midnight at Bombay (Colába) and being reckoned from 0^h to 24^h. One observer (called the morning observer) takes the 6^h observation, a second one (the day observer) those of 10^h, 14^h and 18^h, a third one (the night observer) that of 22^h, and a fourth is relieved from observing duty for one week; the next week the four observers—including the computer who takes regular observing duty—change round in circular order, and so on week by week. On Sundays and general holidays special arrangements are made to set free all but three members of the staff—one being kept on observing duty, one in charge of photographic instruments, and one in charge of the Astronomical Observatory. All the observers reside on the premises, and they are required to keep a general out-look on the weather during the intervals between their respective hours of observing duty and the next earlier observation hours. Each observer reduces his own observation immediately after the entry of the observation in the register, and the reductions are checked by the observer who next comes on duty: amongst the duties of the day observer are included the calculation of daily averages, and the writing out of the monthly abstracts. These latter consist of tables having the days of the month marked in numerical order in the first column and the hours of the day in order at the head of the columns, and there is one for each magnetical or meteorological element observed. Attendance in the computing room is exacted of the observers, when not actually engaged upon observing duty, as well as of the First Assistant, Magnetical Department, Second Assistant, Astronomical Department, and Computer, for six hours daily, exclusive of a break for rest in the middle of the day. Upon the First Assistant devolves the immediate oversight of general observing, computing and photographic operations. The observations of absolute declination, horizontal intensity, and dip, which are repeated once, twice and four times respectively every week, are distributed amongst the more experienced observers in such a manner that no two consecutive weeks' observations shall, as a rule, fall to the same observer. The time of one Assistant is almost entirely absorbed by the photographic operations, the instruments requiring vigilant attention, and the chemical processes demanding much skill and care.

The anemograph is in charge of the Second Assistant, Astronomical Department, who changes the recording paper daily, and tabulates the hourly readings of direction and movement of the wind. The tabulations are checked by the Photographer, between whom and the Second Assistant, Astronomical Department, are divided also the resolution of the tabulations into components and the writing out and checking of wind abstracts, the one performing a set of operations and the other checking them, and so on alternately. The correspondence of the direction record to the actual direction of the vane is frequently checked by turning the instrument to point to the Kennery Lighthouse, the azimuth of which is accurately known. In order to preserve the direction gear in smooth working condition, the fixed toothed wheel is cleaned and oiled—without stopping the instrument—once a week; and every day the direction vane is turned right round the compass once each way, with the object of lubricating both sides of the teeth of the wheel.

All computing operations are systematically performed by one computer and checked, by a repetition of the operation, by another.

7. The eye-observations that are taken five times a day are subsidiary to continuous registrations obtained by means of automatic recording instruments. Of these there are five sets of apparatus,

I. The magnetographs,
II. The barograph,
III. The thermograph,
IV. The pluviograph, and
V. The anemograph,

of which IV is an appendage of III, designed to work with the same light and to trace its curve on the same sheet of sensitive paper. The first four register photographically and the last mechanically.

8. *Instruments and phenomena observed five times a day.*—These are as follows:—

Extent and description of clouds, state of the weather, occasional phenomena, and direction of the wind.	From 5 minutes before to 2 minutes after the exact hour.
Thermograph standard thermometer, dry bulb Do. do. wet bulb	At 2 minutes after the exact hour.
Newman's rain gauge (in wet season)	„ 3 „ „
Thermometer in ground 1 inch deep ... ... Do. do. 9 inches deep ...	From 5 to 7 „
Newman's standard barometer No. 58 and attached thermometer. Do. do. No. 48 ditto.	„ 7 to 9 „
Grubb's declination magnetometer	At 12 „ „
Grubb's horizontal force magnetometer and its thermometer	„ 14 „ „
Vertical force magnetograph No. 2, and its thermometer	„ 16 „ „
Vertical force magnetograph No. 1, and its thermometer	„ 17 „ „
Declination magnetograph	„ 18 „ „
Horizontal force magnetograph and its thermometer	„ 19 „ „
Thermometer attached to barograph ...	„ 20 „ „

The vacuum gauges of the magnetographs are read at 10 hours only, the maximum and minimum thermometers in the magnetograph room are read

and re-set at 10 hours only, and the 20 inches, 60 inches and 132 inches deep ground thermometers are read at 14 hours only.

Newman's rain gauge is read daily at midnight in the wet season, and the discharges of the syphon of the self-registering rain gauge are read once a day or oftener as required.

9. *Other routine operations*:—(1) The anemograph is supplied with fresh recording papers daily.

(2) Fresh sensitive papers are put upon the recording cylinders of the four magnetographs, of the barograph, and of the thermograph and pluviograph every two days. The papers taken off are developed, fixed and washed, and new ones are prepared by the photographer on alternate days.

(3) The tabulation of anemograms is effected as soon as the papers are available, generally, that is, on the day following that to which the record refers. Barograms, thermograms and declination, horizontal force and vertical force magnetograms also are regularly tabulated as soon as the registers are available.

(4) Double sets of observations of vibration and deflection are made with the unifilar magnetometer for the determination of the absolute horizontal force weekly, and with the same instrument observations of absolute declination are also made weekly.

Observations of magnetic dip are made four times a week.

The times of vibration of Grubb's declination and Grubb's horizontal force magnetometers are observed once a year; but each of the magnets is disturbed through a large arc (yet less than 1°) once a month, and the nearness of its return to the undisturbed position is recorded.

(5) Transit observations of stars for the determination of time are made generally on Mondays, Wednesdays and Fridays in the dry months: during the monsoon no opportunity is lost of observing the sun or stars when visible. The adjustment of the transit instrument is frequently tested by reference to the fixed collimator mark; the collimation, level, and azimuthal errors are determined from time to time, and whenever the collimator shows a displacement of the telescope, or any considerable discordances appear in the clock errors derived from observations of stars of different north polar distances.

Remarks on the Condition and Adjustments of the Instruments and on the Processes of Reduction.

10. The object of the following description is to make known such special circumstances in connection with the condition, situation and adjustment of the instruments, with the habits of the observers, and with the routine of the processes of reduction, as are necessary to enable the reader to form an independent judgment of the degree of precision attained, and of the weight to be attached to any conclusions that may be drawn from the observations.

I.—METEOROLOGICAL INSTRUMENTS, 1894.

Barometer.

11. *Description*:—The observations which furnished the fundamental data for the construction of the tables of barometric pressure for the year 1894 were taken with a standard barometer by Newman, marked No. 58, the same which has been used uninterruptedly since the establishment of the Observatory. The internal diameter of the barometer tube, marked by the maker on the frame of the

instrument, is 0·530 inch. The scale, which is of brass, is moveable, and terminates below in an ivory point which is designed to be set, at each observation, so as just to touch the surface of the mercury in the cistern, and the setting is known to be accurate when the point appears just to meet its image reflected from the mercury. The upper part of the scale, which is divided to twentieths of an inch, has a vernier with slow motion screw, reading to thousandths of an inch, and to it are attached two small brass plates with horizontal lower edges before and behind the tube: the setting of the instrument consists in raising and lowering the vernier until the horizontal plane containing these two edges is tangent to the surface of the mercury in the tube of the barometer, and this is the case when it is just so low, and no lower, that when the eye is raised or lowered no light is seen to pass between the central part of the mercurial surface and the two edges. A thermometer with a cylindrical bulb dipping into the mercury in the cistern is attached to the barometer, and is intended to be read at every observation: but an investigation described in the "Bombay Magnetical and Meteorological Observations, 1871-78," Introduction, pages xlii to xlv, showed that the errors of this thermometer—as measuring the temperature of the mercurial column—were considerable, and since the end of 1884 its use has been discontinued: in lieu of it a thermometer by Murray and Heath (No. 2) divided to half degrees, and with its bulb immersed in a column of mercury held in a glass tube of nearly the same diameter as that of the barometer, was fixed on one side of the metal frame of the barometer at about the same height as the middle of the barometric column, and this has been regularly observed since 1885·0. The error of the new thermometer varies by about a quarter of a degree within the annual range of the temperature of the barometer No. 58, and in adopting a mean error throughout small pressure corrections of ± ·0003 are disregarded.

The standard barometer is attached by means of brackets to a flat board which hangs against the wall on the eastern side of the Magnetical Observatory, near the north-east corner of the room, and its cistern has an elevation of 37 feet above the mean sea level at Colába. It was lifted down in May 1866 and the mercury carefully caused to run up to the top of the tube, where it gave the sharp metallic stroke that is indicative of a good vacuum. It is stated in the "Report of the Committee of Physics of the Royal Society, 1840," page 56, where a description is given of a class of barometers of which this is an individual, that the scale is laid off from the zero point from an authentic standard. The tube of the barometer is kept in proper adjustment to verticality.

12. *Error in setting the zero point of the scale, and change of method of observation.*—In the long period that has elapsed since the instrument was mounted (in 1841) there has been a gradual accumulation of scum on the surface of the mercury in the cistern, and the glass cistern became more and more opaque until the reflected image of the ivory zero point of the scale was very obscurely seen, so that the operation of setting the zero of the scale was uncertain to a very sensible degree. For this reason, the method of observation which had always previously been in accordance with the above description, was changed on the 22nd May 1866, so as to avoid the necessity of setting the scale at every observation. The scale was set once for all on that day and the setting screw then removed; and suitable corrections were thereafter applied for the rise and fall of the mercury in the cistern. These were taken from a table calculated by the formula*

$$\text{Capacity correction} = \cdot 04321\ (h_0 - 29\cdot 943)$$

where h_0 represents the uncorrected reading of the barometer. As the departure of the barometer reading from its mean value very rarely reaches 0·4 inch,

* The data for the construction of this formula will be found in the "Bombay Magnetical and Meteorological Observations, 1865 – 70," Introduction, pp. x, xi.

which would require a correction of only ·017 inch, it is very improbable that an error of so much as ·001 inch ever occurs from inaccuracy in the adopted value of the relative capacities of the tube and cistern. Since the change was made, the comparability of the observations for showing variations is, therefore, throughout much better secured.

13. *Corrections applied to the observed readings.*—It was stated in the instructions given in the Report of the Committee of Physics (page 56) that the correction for capillary action in barometers of this description is rendered inappreciable by the large diameter of the tube, and consequently no correction for capillarity has ever been applied. Besides the correction for capacity, two others only have been applied; one, invariably from the first, for reducing the observations to what they would have been if the temperature of the mercury had always been 32° Fahr. and that of the brass scale 62° Fahr., and the other, since 1885·0, to remove the discontinuity that would otherwise have been produced in the records by the change of thermometers: the first was taken from Table II. of the Committee's Report, and the last was a constant reduction of the corrected pressure by ·002 inch. The considerations on which the latter correction was based are as follows: (1) the tabulations of the barograph are known to exhibit correctly the diurnal variations of barometric pressure, free from any sensible influence of variations of the temperature of that instrument;* (2) the mean of twenty-four hourly barograph tabulations on any day is taken to correspond to the mean of the same twenty-four hourly pressures observed with Newman's barometer No. 58 and corrected for the temperatures indicated by the old attached thermometer; (3) it does not follow that the mean of the tabulations for the five observation hours (6, 10, 14, 16 and 22) will then correspond exactly to the mean of the observed pressures for the same hours, because the old thermometer does not indicate precisely the actual variations of temperature of the mercurial column: in fact the latter mean pressure was, on the average of all the observation days of the year 1872, ·0008 inch in excess of the former mean pressure; (4) nevertheless the correspondence for the five observation hours was adopted as near enough to identity with the correspondence for the twenty-four hours, and the recorded mean pressures of the years 1873 to 1884 will thus be ·0008 inch in excess of those of the years before 1873; (5) the old attached thermometer and the thermometer No. 2 by Murray and Heath were read together at the five observation hours throughout the year 1883, and the average excess of the former reading over the latter was found to be 0°·62; (6) hence to make the pressures reduced for the readings of Murray and Heath No. 2 correspond to those reduced for the readings of the old thermometer the former pressures must be decreased by ·0027 × 0·62 = ·0017, or—as the pressures are read and calculated only to thousandths of an inch—by ·002 inch. Thus taking the period before 1873·0 as a standard period, the recorded annual mean pressures of the years 1873 to 1884 will be ·0008 inch too high, and those of 1885 and later years ·0005 inch [= −·0020 + ·0017 + ·0008] too high.

14. *Comparison with the Kew Standard Barometer.*—Indirect comparisons of Newman's barometer No. 58 with the Kew standard have been made through the mediation of two mountain barometers by Negretti and Zambra, numbered 705 and 711: in Bombay these were both found (in July 1876) to read ·011 inch higher than Newman No. 58, whilst in England they had been found to be ·007 and ·006 inch respectively above the Kew standard: hence Newman's No. 58 reads on the average ·004 inch below the Kew standard. It happens that this is exactly the average amount by which the readings of Newman's barometer have been over-reduced for temperature (*see* Introduction to volume for 1871 to 1878, paragraph 72).

*See "Bombay Magnetical and Meteorological Observations, 1871-78," Introduction, pages xxxvii to xlvi.

GROUND THERMOMETERS.

15. Thermometers with their bulbs at the respective depths below the surface of the ground of 1, 9, 20, 60, and 132 inches are regularly observed, the two former five times a day and the three latter once a day at 14 hours. They are all by Newman, of London, and are divided on brass scales, and the value of one division, approximate range of part of scale exposed above ground, and lengths of that part and of one average degree are shown below for each thermometer:—

Depth of Bulb.	Divided to	Approximate Range of exposed part of Scale.	Length of that Range.	Average length of 1°.
Inch.			Inches.	Inch.
1	1°	30° to 145°	8·19	·071
9	0°·2	70° to 115°	5·20	·116
20	1°	35° to 160°	6·73	·054
60	1°	35° to 160°	6·81	·054
132	1°	50° to 140°	6·44	·072

The 1-inch and 9-inch thermometers are on flat brass scale frames, which lie against wooden posts in the ground, and they have their bulbs in contact with the loose red earth which fills the holes in which they are placed; the 20-inch, 60-inch, and 132-inch thermometers have their lower parts enclosed in brass tubes with ends curving off to a point, and the upper parts are in wooden box frames, to which the brass scales are fixed. The reason why only one observation is made daily of the three deeper thermometers is, that it had been found by hourly observations in 1849, 1850 and 1851, that no appreciable diurnal variation of temperature reached the depth of 20 inches.

The errors of graduation of the ground thermometers are unknown.

THE ROBINSON-BECKLEY ANEMOGRAPH.

16. *Description.*—From the beginning of the month of June 1867 was brought into use an anemograph of the kind designed by Robinson, with improvements by Robert Beckley, and it remains in action to this day. It was made by Mr. R. W. Munro, and was supplied through the Kew Committee of the British Association, after being tested at the Kew Observatory. In this instrument the arrangements for the registration both of movement and direction of the wind are mounted on one shaft, and the registrations are made on a single sheet of paper, which is changed daily. The essential part of the apparatus for measuring the movement is a vertical spindle, to which cross arms are attached at the top, carrying four hemispherical cups of copper. The cups are attached to their several arms, so that, looking from the central axis, their convex sides are seen turned to the right hand, and the wind, acting with greater effect upon the concave than on the convex sides of the cups, causes the system to rotate in a right-handed direction. It is the number of these rotations, 140 of which are reckoned to a mile of movement of the wind, that tells us how fast the wind has been blowing; and the number is reduced, by means of wheelwork, 7,000 times before reaching a small cylinder, carrying a brass spiral pencil that traces the movement on the registering paper; this latter is metallic paper of the kind used for pocket-books, and is wrapped round a brass cylinder, which is kept rotating by clockwork, and as the paper passes under the spiral pencil, which presses slightly upon it, the black movement trace is received upon it. The wind vane, which consists of a pair of windmill vanes with connecting spindle having an endless screw in the middle, and gearing into a fixed horizontal toothed wheel, is attached to a tube that surrounds the lower part of the vertical movement spindle; to the bottom of the tube is fixed a toothed wheel, which, in communication with other such wheels, conveys the motion of the vane *unchanged* to a small cylinder with spiral pencil, which traces the changes of direction on the register;

and it is so arranged that the movement and direction are traced on parallel strips or bands of the same sheet of paper. The heavy parts of the instrument—the direction vane and appendages, and two long brass tubes which connect the instrument proper with the recording apparatus—are supported on friction balls which run in grooves partially filled with oil, thus reducing the friction to a minimum. The instrument is erected on the old Time Ball Tower, at a height of 53 feet above the ground, and 95 feet above the mean sea level, over a platform 12 feet in diameter, which is designed to give ready access to the instrument, and to protect it from irregular currents of wind, glancing from the convex surface of the dome; and it is supported outside by a fixed cast-iron standard, to which is attached, at the top, the toothed wheel, into which the endless screw of the spindle connecting the windmill vanes gears. The centres of each pair of opposite hemispherical cups are four feet apart, and three and a half feet above the platform, and the diameter of the cups is nine inches. The diameter of the vanes is 15 inches, and the breadth of the fans four inches. The register form is printed in red, with lines dividing its length into hour spaces; and its breadth, on the movement side, into five spaces, each representing 10 miles of movement of the wind, and numbered from 0 to 50 miles; and on the direction side into spaces corresponding to 11¼ degrees on each side of the 16 principal directions N.N.E., N.E., &c..... N.N.W., N., which spaces are numbered consecutively 1, 2, &c..... 15, 16.*

17. *Tabulation of Anemograms.*—Numerical tabulations have been made of the movement and direction of the wind during the interval between every two successive hours in the following manner:—the number of miles indicated at the point where the velocity trace cuts a horizontal hour-line being read for two successive hours, the excess of the latter over the former reading (adding 50 if the trace has passed over from left to right of the form) gives the movement for the interval; and the number of the space in which the direction trace lies during the interval is entered as representing the direction. The estimations of movement are made only to the nearest full mile. Should the direction trace not lie all in one space during the whole interval of an hour, then if the change of direction exceed 90° or eight points, the whole observation for that hourly interval is rejected; but if it lie within that limit, the direction is estimated—by an inspection of the movement and direction traces together—whence the aggregate flow of air was the greatest, and this direction is adopted for the full hour. On the average of the years 1871 to 1883, out of 8,754 hours during which the instrument was in action, 3 only had to be rejected because the direction of the wind varied more than eight points within the hour.

18. *Method of reduction.*—Hitherto we have had to speak of phenomena liable only to simple increase and decrease of value, and not subject to any change of quality. Such phenomena being properly and completely evaluated by simple numbers, we may apply to the numbers any arithmetical operations, such as averaging, and infer from the results of those operations corresponding properties of the phenomena. But we have now come to a phenomenon which requires two numbers to express it, one representing its amount and the other a varying quality; the first referring to the velocity, and the last to the direction of the wind. Here we may no longer apply arithmetical processes directly and indiscriminately to the observed numbers: but, the subject being one of motion, we must treat them according to the principles of the science of motion. These principles tell us that the motions may be equally well expressed by means of two varying numbers referring to two invariable qualities, as by a varying number referring to a varying quality; and they show us how to obtain either form of expression from the other. The invariable qualities chosen in the present case are the directions north and east, the actual wind blowing in

* A more detailed account of the Colába anemograph will be found in the "Bombay Magnetical and Meteorological Observations, 1865 to 1870," Appendix I., page 199.

each hour being resolved into north and east components, which may be regarded separately as the velocity of the wind in the invariable direction north or south, and the velocity of the wind in the invariable direction east or west. The resolutions are effected by means of the formulæ :—

$$\text{North component of velocity of wind} = m \cos (n \times 22\tfrac{1}{2}^\circ),$$
$$\text{East component of velocity of wind} = m \sin (n \times 22\tfrac{1}{2}^\circ),$$

where m is the movement observed, and n the number of the direction space under which the wind of the hourly interval is classed. When the sign of either of these calculated quantities is negative, it implies that the wind blows from the opposite direction, *i. e.* from south or west. The calculations are readily made by means of tables to the nearest tenth of a mile of velocity per hour. Having now substituted the two equivalent winds for the real one, we may with propriety proceed to combine together numbers of observations by algebraical addition and averaging, treating the north and east components of the wind each by themselves. The averages thus found from the observations of any given period will represent the velocity with which the wind must blow from the northward (from the southward if the sign of the average be negative) continuously for the whole period, in order that the total movement of the wind from that direction may be the same as the total movement from the same direction produced by the winds which actually blow, and similarly the velocity with which it must blow continuously from the eastward (westward if the sign of the average be negative).

No corrections have been applied to the anemograph tabulations on account of friction.

Rain Gauge.

19. *Newman's Rain Gauge.*—This instrument is made of copper, and exposes for the collection of rain-drops a circular surface of an average diameter of 12·035 inches, forming the top of a funnel, that carries the rain into a cylindrical vessel below, having a diameter of 5·732 inches: a float of slightly less diameter, so as to rise and fall freely, rests upon the water in this vessel, and having a wholly convex external surface, it allows the rain as it falls to flow off and raise the level of the water and with it the float; to the middle of the float is fixed a wooden rod, graduated with divisions, each of which represents ·05 inch of rain; and the readings of this scale, which are easily estimated to fifths of a division, are made where it is cut by the upper edge of a light brass rod placed horizontally across the mouth of the funnel, but half an inch below the edge of the exposed circular surface; the scale passes through a hole in the middle of the horizontal rod, and is thus kept always in a vertical position. The range of the scale is from 0 to 4·00 inches, and the readings of the scale have been entered in the meteorological register and the differences been taken for every interval between successive observations: the rain has accumulated in the vessel generally till the reading was somewhere above 2·00 inches, when the water was let out, by means of a brass cock at the bottom, till the reading came down to 0·00 inch. This latter reading was also maintained during intervals of dry weather—when, from evaporation, the scale would otherwise have fallen lower—by pouring small quantities of water into the gauge; the reason of this is obvious, as, if some water were not always retained, the float would sometimes rest on the bottom of the vessel and so cease to perform its function of rising equally for equal increments of rain. The scale on the wooden rod was graduated so as to agree approximately with the data—the diameters of the gauge and measuring vessel—given above. The error of the scale according to which the rod was graduated was less than a thousandth of the whole.

Newman's gauge stands on a large rectangular block of stone, in a position intermediate between the Entrance Gate, the Magnetical Observatory, and the

Thermograph Shed, where the altitude of the highest neighbouring object, as seen from the gauge, is about 30°. It is supported by three feet, which are embedded with lead in holes cut in the stone block, and its circular mouth is at a height of 4½ feet above the ground and about 35 feet above the mean sea level.

Barograph and Thermograph.

20. Like the anemograph, the Colába barograph and thermograph were supplied through the Kew Committee of the British Association, after being tested at the Kew Observatory; and they are of like construction with those adopted by the Meteorological Committee of the Royal Society for the seven observatories established by them in the year 1867 in the United Kingdom. An account of these instruments in general, with notes on the peculiarities of the Colába set and on special points in the Colába arrangement of them and utilization of their registrations, will be found in the 1871—78 volume of this series, Introduction, pages xvi to xlvi.

21. *Thermograph.*—The height of the bulbs of the thermometers above the ground is 10 feet. The cage is placed on one of the most exposed parts of the Observatory grounds and away from any building: it is, however, screened, as well as the thermograph room in which the recording apparatus is placed, by a roomy shed with a planked roof that is everywhere 2 feet above the roofs of the cage and room: the sides of the shed are of the louvre construction on an enlarged scale, with double sheets of zinc enclosing a thick layer of felt substituted for the wooden laths, and with a vertical distance from lath to lath of one foot: the lowermost two feet of the sides are guarded simply by horizontal iron rods: the roof of the shed is covered with thick felt and then with strong canvas, and the whole of the exterior—sides and roof—is painted or limewashed white.

Pressure of Vapour.

22. *Pressure of Vapour and additional capacity of the Air.*—Having obtained from the tabulations of the barograms and thermograms hourly values of barometric pressure, temperature of the air, and temperature of evaporation, the pressure of vapour was calculated for each hour with the aid of a table by the formula

$$f''=f'-\cdot01147\,(t-t')\times\frac{P-f'}{30}$$

in which t and t' denote the temperatures of the air and wet bulb thermometers respectively, f'' and f' the pressure of vapour at the temperature of the dew point and at temperature t', and P the barometric pressure. The values of the pressure of vapour at different temperatures were taken from the following table, the numbers in which have been extracted from Boileau's 'Collection of Tables':—

Table 1.—*Regnault's values of the Pressure of Vapour at different Temperatures.*

Temperature.	Pressure of vapour.	Temperature.	Pressure of vapour.	Temperature.	Pressure of vapour.	Temperature.	Pressure of vapour.	Temperature.	Pressure of vapour.	Temperature.	Pressure of vapour.	Temperature.	Pressure of vapour.	Temperature.	Pressure of vapour.
°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.
35	·204	43	·278	51	·374	59	·500	67	·662	75	·868	83	1·128	91	1·455
36	·212	44	·288	52	·388	60	·518	68	·685	76	·897	84	1·165	92	1·501
37	·220	45	·299	53	·403	61	·537	69	·709	77	·927	85	1·203	93	1·548
38	·229	46	·311	54	·418	62	·556	70	·733	78	·958	86	1·242	94	1·597
39	·238	47	·323	55	·433	63	·576	71	·758	79	·990	87	1·282	95	1·647
40	·248	48	·335	56	·449	64	·596	72	·784	80	1·023	88	1·324	96	1·698
41	·257	49	·348	57	·466	65	·617	73	·811	81	1·057	89	1·366	97	1·751
42	·267	50	·361	58	·482	66	·639	74	·839	82	1·092	90	1·410	98	1·805

To find the additional capacity of the air the pressure of vapour was deducted from the number in the above table standing opposite to the temperature of the air.

Self-registering Rain Gauge.

23. A description of this instrument also will be found in the Introduction to the "Bombay Magnetical and Meteorological Observations, 1871 to 1878," page xlvi. In 1894 the syphon discharges were received in glass bottles and measured by means of a graduated glass tube and a marked glass bottle holding exactly half an inch of rain.

24. It was mentioned in former years that the occurrence of the discharging action of the syphon was occasionally liable to some uncertainty—the water at times trickling over the bend of the tube in considerable quantities before the proper discharge commenced. After trial of many modifications in the form of the syphon one was at last hit upon, which is free from this fault, and by which the tube is, moreover, kept in a satisfactorily clean condition from beginning to end of the monsoon, simply by the washing that takes place in the ordinary automatic discharges. Since November 1884, when the new syphon was brought into use, the discharges have been regular and unfailing except on two occasions, *viz.*, on the 18th June and 5th November 1890 when trickling again occurred: this was traced, in the last case, to the presence near the bend of the syphon tube of a living cockroach. To prevent this from occurring again, a lid of zinc was fitted to the discharge pipe at its entry into the receiving bottle, so as to cover the mouth of the bottle.

25. To prevent birds alighting upon the funnel, and choking it with their droppings, a conical arrangement of pointed iron spikes surrounding the funnel was attached in 1882, and was found to be effective.

26. *Constants for converting syphon discharges into inches of rainfall.*—As the surface exposed by the rain gauge funnel is 50·286 square inches, an inch of rain contains 823·955 cubic centimeters. With the aid of a cubic centimeter measure,* 412 cubic centimeters of water were poured into a narrow-necked glass bottle, and a file mark was made on the bottle neck at the level up to which the water rose. A glass tube was also graduated by means of the same cubic centimeter measure, so as to read off thousandths of an inch of rain with ease. The bottle is filled as often as there have been discharges from the rain gauge syphon, and the final excess or defect is measured with the graduated tube. The use of the bottle began on 31st July 1879 and continued till the 26th July 1884, when it was accidentally broken. An exact copy of it, which had been prepared beforehand, was then substituted for the original bottle, and this copy is still in use.

27. *Measurement and distribution of syphon discharges.*—The discharges are measured daily, or oftener during heavy rainfall, and are of course always of an integral number. For each measurement the average value of a discharge is attributed to each of the intervals of time, shown on the rain curve, between pairs of successive discharges; and it remains then only to distribute this quantity, for each filling of the receiving vessel, by means of tabulations of the ordinates of the rain curve. When, as is often the case, the rate of fall of the rain at the time of a discharge exceeds 1½ inch per hour, it is necessary to allow for the rain that enters the receiving vessel during the known time (16 seconds) of discharge, the allowance depending on the rate of rainfall, which is easily estimated for this purpose by noting, with the aid of an appro-

* Lent by Mr. F. Chambers, whose verification data show it to be accurate to a thousandth of the 100 cubic centimeters which it is designed to measure.

priate paper scale, the inclination of the rain curve immediately after the time of discharge. The aggregate of such allowances is deducted from a day's (or other) measurement before dividing the quantity equally amongst the several intervals.

28. *Determination of scale of rainfall ordinates.*—The factor for converting ordinates of the rainfall curve into inches of rainfall was found by experiments in which a determined weight or volume of distilled water was poured into the receiving vessel, and the change of length of the ordinate produced thereby was carefully measured. In an experiment made on the 19th March, 1894, the quantity of water poured into the vessel was equivalent to ·480 inch of rain, and the change of length of the ordinate ·480 of a true inch; whence the factor is found to be 1·000, which is applicable to all the rainfall registrations of the year 1894.

29. The tabulations are made with the true-inch scale of the thermograph tabulating instrument, using the white line as datum; and the reading of this datum that shall correspond to the reading ·000 of the rain curve, when the receiving vessel has just been discharged, is re-determined whenever the adjustment of the recording apparatus is disturbed. For this purpose an average is taken of a number of measurements for all of which the rain is falling very slowly at the time of the syphon's coming into action and for a short time longer. It is necessary to select such occasions, because at times of heavy rainfall the curve has risen sensibly before the light has had time to make a distinct impression on the sensitive paper. The mode of tabulating is (1) to set the scale on the constant reading corresponding to the white line, (2) to move the sliding piece until the index is set upon the white line, and (3) to move the sliding bar till the index is set upon the curve, and then read the scale. By setting the paper carefully, so that a considerable length of the white line is practically parallel to the lateral motion of the frame, the repetition of the first two operations of tabulation is avoided until many hourly ordinates have been read; and then a new setting of the paper is made for another stretch of the white line.

Description of the Tables of Meteorological Results and of the Processes of Reduction, 1894.

30. *Barometric Pressure.*—In Table I is shown, for every day in the year, the mean of 24 hourly tabulations of the barograph, corrected* to agree with Newman's barometer No. 58;—also the mean pressure for each month and each year, and the excess of each monthly mean above the annual mean for the same year; and the principal features of the annual variation are indicated at the foot of the table. The maximum and minimum daily pressures in each month are distinguished by being printed in strong figures.

31. *Temperature of the Air, &c.*—The plan of the following tables is the same as that of Table I, but the subjects of them and the sources from which the numbers are obtained and the mode of obtaining them are as stated below:—

Table II.—Temperature of the air: derived from hourly tabulations of the thermograph dry-bulb.

Table III.—Pressure of vapour: derived from hourly tabulations of the thermograph dry-bulb and wet-bulb, and of the barograph; and calculated in the manner described in paragraph 22.

Table IV.—Additional capacity of the air; derived from hourly differences between the pressure of vapour corresponding to the temperature of the air and the calculated actual pressure of vapour.

* In the manner described in paragraph 54 of the Introduction of the "Bombay Magnetical and Meteorological Observations for 1871 to 1878."

Table VII.—Velocities of the north and east components of the wind: derived from hourly tabulations from the register of the Robinson-Beckley anemograph.

Table VIII.—Velocity of the wind regardless of direction: derived from hourly tabulations from the register of the Robinson-Beckley anemograph.

Table XI.—Extent of cloudy sky: derived from estimations made at the hours 6, 10, 14, 16 and 22 daily.

32. Tables VI and XII are on the same plan as Table I, except that the entries made in them are aggregates—daily, monthly and yearly—instead of mean values; and they are sufficiently explained by their several headings.

33. *Monthly and annual range of variation of Meteorological Elements.*—Table V shows the extreme limits between which the oscillations of barometric pressure, temperature of the air, pressure of vapour, and additional capacity of the air were confined in each month and in the whole year, and also the ranges of the respective oscillations.

34. The numbers in Table IX are derived from hourly tabulations from the register of the Robinson-Beckley anemograph. The temperatures of the ground given in Table X are derived from the readings of the several thermometers, made five times a day as regards the 1 inch and 9 inches deep thermometers, and once a day as regards the 20 inches, 60 inches and 132 inches deep thermometers. The five-day means of Table XIII are derived from hourly tabulations of the barograph (combined with readings of Newman's barometer No. 58) and thermograph, from the measurements in Newman's rain-gauge, and from hourly tabulations from the register of the Robinson-Beckley anemograph. In other respects these tables require no explanation beyond their titles, the headings of the several columns, and the foot-notes.

Notes on instrumental changes and on all irregularities or departures from the routine of observation or reduction in 1894.

35. *Robinson-Beckley Anemograph.*—Instrument dismounted and cleaned on May 20 and 22. External parts painted on November 17. The aggregate of all the interruptions of the instrument in the year 1894 was $12^h\cdot14^m$: the loss of record was, however, rarely complete, and values partly or entirely interpolated have been inserted whenever the interruption was not somewhat prolonged. To aid in the making of interpolations, it has been customary, whenever the action of the instrument was voluntarily interrupted for more than one hour, to observe the direction of the wind by estimation, and to record the readings of a small auxiliary velocity measurer put up for the occasion. No complete day's records have been omitted in the formation of monthly abstracts.

36. When for any reason the traces furnished by the photographic self-registering instruments are interrupted, and the interruption includes the moments when one or more hourly tabulations should be made, these last are either substituted by the corresponding eye-observations, if the hours should happen to be any of the five regular observation hours, or if special eye-observations were taken for the purpose, or else, if no eye-observations are available, they are interpolated. In the last case, if the interruption lasts for less time than one hour, the interpolation is made on the assumption that the rate of change of the phenomenon from its value at the beginning to its value at the end of the interruption was uniform, providing that the parts of the curve immediately preceding and immediately following the gap were, in appearance, continuations of the straight line connecting the extremities of the gap. If the last condition is not satisfied, or if the gap, taking account of points inserted by means of eye-observations, is of greater length than one hour, the interpolation is made

between the next preceding and the next following hourly entries, first, by allowing for the known *normal* rate of change of the phenomenon between those hours in the same month, and then by assuming that any additional change, shown by the difference between the values of the phenomenon at the two extreme hours, has grown at a uniform rate. Interpolated values are entered in the abstract sheets with enclosing square brackets—inserted eye-observations between parentheses.

37. *Barograph.*—No tabulation was obtained for 14 hours of 25th May 1894 on account of a stoppage of the clock, but an eye-observation was available and was adopted.

Occasional, though rare, failure of the bi-hourly stops to act has caused no loss of record.

The aggregate of all the interruptions of the barograph in the year 1894 was $2^h\ 1^m$*, and the number of hourly tabulations lost was only 1 which was substituted by an eye-observation.

38. *Thermograph dry-bulb.*—Occasional, though rare, failure of the bi-hourly stops to act has caused no loss of record.

The aggregate of all the interruptions of the thermograph dry-bulb in the year 1894 was only $0^h\ 16^m$. No hourly tabulation was lost.

39. *Thermograph wet-bulb.*—Occasional, though rare, failure of the bi-hourly stops to act has caused no loss of record.

The aggregate of all the interruptions of the thermograph wet-bulb in the year 1894 was $9^h\ 9^m$, made up chiefly of short intervals of time occupied in cleaning and renewing the muslin coverings of the bulbs and the bundles of threads connecting them with the supply of water. No hourly tabulation was lost.

40. *Self-registering Rain-gauge.*—No hourly tabulations were lost in the year 1894.

II.—MAGNETICAL INSTRUMENTS, 1894.

Kew Absolute Declinometer and Deflection and Vibration Apparatus.

41. A description of this instrument, with which the observations of absolute declination and of horizontal intensity for the year 1894 have been taken, will be found on pages xxxiii to liii of the Introduction to the "Bombay Magnetical and Meteorological Observations, 1865—70"; the description includes also an account of the situation of the instrument, of the nature and routine of the observations taken with it—with examples of observation and computation forms filled up with the figures of actual observations—and of the formulæ of reduction and the constants involved in them.

42. The entries in columns 1 to 17 and 19 of the Tables of Observations of Absolute Horizontal Force are copied directly from the computation form: column 18 is given to show the degree of accordance existing in the determinations from deflections with the deflecting magnet at the respective distances 0·8 foot and 1·0 foot from the deflected magnet; and the numbers in column 21 are the products of those in column 20 multiplied by the constant number ·46108.

43. The description, referred to above, of the observation of absolute declination will render clear the meaning of the numbers entered in each column of the Tables of Observations of Absolute Declination: all of these, except the monthly means in columns 12 and 13, are taken directly from the observation form.

* If not unusually prolonged, the short interruptions caused by the regular changing of photographic papers and by changing of lamps are not included in the above aggregate, nor in the aggregates of interruptions of the thermograph that follow further on.

Kew Dip Circle.

44. A description of this instrument, and of the mode of using it, is also given in the Introduction to the "Bombay Magnetical and Meteorological Observations, 1865—70," pages lvi to lix, and the following additional or corrective remarks will make it applicable to the observations of 1894:—

(1) The place of observation has been the top room of the Electrometer Tower, the dip circle having been placed on the same pillar on which the Kew unifilar magnetometer is placed in the regular observations of absolute horizontal force and absolute declination. The reading of the azimuth circle adopted for this place has invariably been 63° 31′. An observation for the verification of this reading was made on the 22nd February 1881.

(2) The dip needles used during the year 1894 have been as follows:—

For the regular observations:—

Dover, Charlton No. 1.
„ „ No. 2.

And for supplementary observations:—

John Dover No. $\frac{1}{a}$.
„ „ No. $\frac{2}{a}$.

(3) The final cleaning of the axles of the needles has throughout been made with a clean silk cloth.

(4) The spider lines of the microscopes of the dip circle were renewed on the 1st October 1894, as the old ones had become slackened and distorted.

CHARLES CHAMBERS,
Director.

Colába Observatory, September 1895.

TABLES OF RESULTS

DERIVED

FROM THE CONTINUOUS REGISTRATIONS OF AUTOMATIC METEOROLOGICAL INSTRUMENTS

AND FROM

METEOROLOGICAL OBSERVATIONS,

1894.

TABLES OF RESULTS

DERIVED FROM THE

METEOROLOGICAL OBSERVATIONS MADE DAILY AT 6, 10, 14, 16 AND 22 HOURS,

1894.

FIVE-DAY MEANS,

1894.

B 983—1 R

Table I.—Barometric Pressure, 1894.

Height of Barometer above mean Sea-level = 37 feet.

1894. Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
1	29·899	29·945	29·821	29·847	29·834	29·717	29·709	29·719	29·772	29·815	29·850	29·923
2	·935	·960	·860	·817	·832	**·729**	·684	·718	·738	·822	·803	·919
3	·923	·960	·863	·823	·817	·727	·671	·720	·733	·812	**·798**	·884
4	·888	·949	·863	·841	·800	·705	·665	·685	·751	·822	·828	·884
5	·882	·924	·806	**·851**	·790	·682	·668	·652	·752	·830	·886	·880
6	·924	·918	**·795**	·804	·787	·645	·673	·626	·759	·866	·918	·910
7	·949	·940	·877	·817	·797	·641	·640	**·614**	·769	·888	·919	·907
8	·957	·948	·884	·808	·748	·615	·613	·653	·749	·869	·954	·914
9	·954	**·963**	·870	·802	·744	·645	·579	·667	·699	·853	·978	·965
10	·968	·952	·855	·819	·792	·637	·618	·647	**·693**	·842	·954	·960
11	·952	·947	·861	·830	·829	·639	·685	·643	·764	·802	·957	·882
12	·944	·962	·841	·791	·810	·605	·692	·683	**·824**	·769	·965	**·845**
13	·947	·933	·885	·780	·783	·541	·656	·690	·799	·775	·958	·879
14	·924	·917	·860	·797	·806	·554	·713	·673	·736	·827	·993	·971
15	·897	·938	·845	·822	**·852**	·569	·733	·678	·701	·817	**30·009**	·987
16	·914	·957	·842	·830	·844	**·513**	·721	·675	·719	·795	29·994	·963
17	·904	·930	·847	·783	·817	·524	·673	·634	·758	·786	30·000	·965
18	·907	·908	·797	·740	·815	·582	·580	·628	·771	·781	29·958	·975
19	·895	·908	·805	·722	·813	·637	**·498**	·627	·789	·768	·916	·987
20	·900	·899	·844	·751	·792	·675	·505	·619	·782	·732	·938	·998
21	·961	·928	·891	·777	·791	·674	·538	·665	·798	·746	·987	·972
22	**·974**	·906	·887	·779	·792	·639	·562	·716	·788	·714	·989	·979
23	·926	·854	·880	·759	·776	·617	·630	·744	·758	**·701**	·990	**30·021**
24	·875	**·805**	·874	·737	·759	·611	·705	·760	·738	·717	·973	·002
25	**·849**	·822	·846	**·719**	·750	·650	·694	·794	·746	·754	·950	29·969
26	·893	·916	·839	·731	·719	·701	·677	**·812**	·748	·707	·953	·944
27	·955	·904	·828	·761	**·694**	·678	·718	·799	·763	·794	·901	·949
28	·966	·862	·840	·758	·703	·648	·717	·758	·785	·880	·884	·968
29	·963		·886	·749	·743	·633	·710	·726	·780	**·913**	·889	·983
30	·972		**·904**	·774	·742	·691	·733	·724	·786	·907	·902	·972
31	·961		·896		·720		**·741**	·764		·884		·941
Monthly Mean.	29·928	29·920	29·855	29·787	29·784	**29·636**	29·658	29·694	29·758	29·806	29·933	**29·945**
Annual Variation ...	+·119	+·111	+·046	—·022	—·025	—·173	—·151	—·115	—·051	—·003	+·124	+·136

	in.
Annual mean	29·809
The greatest mean daily barometric pressure in the year (that of 23rd December) was	30·021
The least do. do. do. (that of 19th July) was	29·498
Difference =	0·523

TABLE II.—Temperature of the Air, 1894.

1894. Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	°	°	°	°	°	°	°	°	°	°	°	°
1	75·3	72·4	77·3	81·8	83·1	86·7	82·6	81·6	79·7	79·4	77·8	76·8
2	74·4	72·9	77·2	80·6	83·1	86·0	83·1	80·8	78·9	79·1	77·6	77·4
3	74·2	73·0	77·6	80·6	83·3	86·5	83·4	81·3	80·0	77·8	77·5	76·1
4	73·3	76·6	78·4	80·2	84·3	86·4	82·8	81·5	80·3	78·5	77·5	75·4
5	72·9	77·6	77·3	80·6	84·3	86·5	83·0	81·6	79·3	78·1	77·5	75·6
6	75·4	77·7	76·3	82·3	84·4	86·0	82·3	81·2	80·1	78·2	77·9	75·3
7	77·0	76·5	76·3	82·0	84·2	84·6	82·0	81·7	78·7	79·4	79·0	74·9
8	77·1	76·2	76·3	81·1	84·2	82·1	80·9	81·5	79·4	80·7	79·1	75·9
9	75·6	76·7	77·6	80·9	84·8	80·3	78·7	81·8	77·9	82·6	78·3	78·3
10	75·1	76·8	78·3	80·6	85·0	80·3	78·1	81·7	76·7	81·3	76·5	76·9
11	75·1	77·6	77·1	81·1	84·1	78·4	79·6	80·4	77·7	81·6	78·0	75·9
12	75·3	77·9	77·3	82·2	83·8	78·8	80·0	80·3	79·6	81·7	79·6	74·3
13	75·3	79·1	78·0	83·3	83·4	80·0	80·4	80·7	80·5	81·8	78·1	72·3
14	75·1	78·7	80·0	83·6	83·7	81·9	80·9	80·8	79·9	80·3	77·1	71·9
15	74·8	78·8	80·1	83·6	84·4	80·8	80·8	80·9	78·1	81·0	77·2	72·6
16	74·0	78·1	80·3	81·6	84·5	81·2	77·2	80·5	77·4	81·0	77·7	74·2
17	73·7	78·6	80·7	81·6	84·7	78·8	77·8	80·3	78·8	82·1	78·8	75·5
18	74·9	76·8	81·3	82·1	84·8	81·4	79·1	80·9	76·9	82·1	78·7	77·2
19	76·0	74·8	81·4	82·5	84·7	83·5	79·2	76·8	80·0	81·6	78·3	77·9
20	75·6	74·7	81·2	83·2	84·8	84·0	78·7	80·8	80·3	81·8	77·7	77·1
21	75·8	75·0	81·0	83·3	85·2	83·3	78·5	80·7	78·5	82·4	77·3	76·2
22	75·0	76·6	81·3	84·0	85·0	83·2	80·1	79·0	78·0	82·6	79·5	76·4
23	75·4	76·9	80·9	84·6	84·7	83·2	80·4	79·6	79·3	79·5	79·0	76·6
24	75·3	77·3	81·0	85·3	85·0	83·3	80·7	80·3	78·3	78·8	78·8	75·1
25	75·9	77·6	82·9	84·0	85·1	83·6	81·1	81·0	78·4	78·1	78·4	73·3
26	77·7	78·1	82·0	84·0	85·2	83·7	81·2	81·5	79·5	78·1	78·2	73·2
27	76·7	77·2	80·7	83·9	85·3	83·9	81·5	81·2	78·9	78·6	77·4	75·6
28	75·0	76·8	80·2	83·6	85·1	83·6	81·3	80·5	79·9	79·1	77·1	76·6
29	73·7		80·9	82·7	85·5	83·7	81·5	76·6	78·9	79·7	77·1	75·9
30	73·4		80·9	83·5	85·4	83·1	81·4	77·1	79·9	79·9	76·5	74·6
31	72·6		81·7		86·1		81·2	79·7		78·2		74·5
Monthly Mean.	75·1	76·7	79·5	82·5	84·6	82·9	80·6	80·5	79·0	80·2	78·0	75·5
Annual Variation	—4·5	—2·9	—0·1	+2·9	+5·0	+3·3	+1·0	+0·9	—0·6	+0·6	—1·6	—4·1

	°
Annual mean	79·6
The greatest mean daily temperature of the air in the year (that of 1st June) was	86·7
The least do. do. do. (that of 14th December) was	71·9
Difference =	14·8

Table III.—Pressure of Vapour, 1894.

1894. Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
1	0·690	0·516	0·726	0.823	0·794	0·937	0·901	0·902	0·827	0·841	0·684	0·640
2	·653	·486	·718	·830	·820	·955	·890	·888	·845	·816	·676	·660
3	·593	·485	·737	·790	·854	·959	·908	·897	·842	·805	·631	·674
4	·503	·579	·727	·784	·900	·924	·893	·892	·801	·787	·649	·728
5	·533	·746	·707	·833	·888	·934	·914	·880	·878	·777	·635	·699
6	·656	·794	·659	·810	·887	·943	·909	·896	·881	·791	·671	·638
7	·694	·695	·630	·853	·844	·944	·900	·899	·873	·822	·709	·636
8	·655	·635	·666	·812	·819	·921	·897	·899	·898	·866	·677	·660
9	·614	·627	·656	·793	·855	·927	·879	·894	·862	·902	·623	·695
10	·601	·660	·625	·807	·856	·940	·873	·887	·844	·903	·642	·704
11	·584	·717	·544	·831	·847	·877	·908	·878	·861	·905	·716	·674
12	·609	·724	·584	·855	·848	·878	·914	·876	·854	·913	·676	·588
13	·605	·716	·681	·827	·820	·881	·916	·888	·842	·903	·649	·509
14	·604	·667	·645	·832	·846	·934	·912	·874	·848	·858	·632	·491
15	·614	·704	·791	·828	·838	·928	·897	·858	·853	·904	·602	·588
16	·586	·695	·829	·838	·828	·950	·848	·869	·838	·891	·657	·689
17	·574	·604	·841	·859	·833	·898	·885	·860	·856	·876	·718	·686
18	·623	·590	·867	·867	·858	·959	·912	·883	·835	·807	·739	·714
19	·613	·524	·863	·871	·840	·959	·893	·845	·871	·863	·748	·683
20	·619	·599	·852	·909	·851	·945	·896	·881	·850	·855	·740	·675
21	·599	·635	·819	·919	·859	·932	·891	·870	·850	·863	·705	·694
22	·602	·682	·754	·937	·847	·942	·905	·849	·829	·880	·697	·692
23	·645	·708	·640	·937	·878	·954	·888	·840	·836	·887	·678	·708
24	·621	·635	·719	·884	·899	·942	·888	·844	·845	·876	·673	·649
25	·665	·721	·712	·844	·921	·938	·882	·856	·829	·841	·652	·516
26	·720	·756	·684	·866	·906	·930	·890	·848	·845	·877	·599	·566
27	·743	·748	·710	·870	·869	·924	·882	·840	·828	·887	·592	·646
28	·676	·717	·757	·826	·824	·898	·879	·830	·866	·874	·622	·657
29	·558		·821	·740	·871	·911	·867	·798	·864	·861	·636	·621
30	·529		·738	·767	·889	·912	·871	·819	·855	·859	·621	·627
31	·528		·828		·906		·893	·849		·703		·652
Monthly Mean...	0·616	0·658	0·727	0·841	0·858	0·929	0·893	0·867	0·852	0·855	0·665	0·647
Annual Variation ...	—·168	—·126	—·057	+·057	+·074	+·145	+·109	+·083	+·068	+·071	—·119	—·137

	in.
Annual mean	0·784
The greatest mean daily pressure of vapour in the year (that of 3rd June) was	0·959
The least do. do. do. (that of 3rd February) was ...	0·485
Difference =	0·474

TABLE IV.—Additional Capacity of the Air, 1894.

1894.	MONTH.											
Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
1	0·189	0·286	0·215	0·267	0·340	0·336	0·213	0.176	0·186	0·163	0·266	0·292
2	·201	·327	·217	·216	·315	·289	**·243**	·163	·141	·179	·274	·287
3	·256	·336	·210	·264	·288	·304	·235	·170	·182	·150	·317	·230
4	**·322**	·353	·247	·251	**·279**	**·339**	·229	·182	·176	·189	·298	**·156**
5	·284	**·305**	·233	**·215**	·292	·332	·215	·200	·123	·187	·315	·192
6	·229	**·159**	·251	·297	·297	·302	·195	·168	·148	·177	·290	·241
7	·241	·220	·277	·242	·334	·224	·193	·184	·107	·185	·290	·240
8	·280	·271	·245	·253	·357	·179	·159	·180	·106	·187	·324	·241
9	·277	·295	·297	·263	·346	·106	·101	·192	·093	·214	·356	·279
10	·278	·271	·348	·242	·351	·094	·088	·195	**·075**	·166	·277	·224
11	·292	·236	·394	·234	·325	·095	·103	·160	·090	·176	·249	·221
12	·276	·238	·362	·249	·312	·106	·110	·158	·159	·171	·342	·264
13	·276	·284	·283	·316	·327	·144	·120	·160	**·201**	·185	·318	·286
14	·272	·320	·383	·323	·309	·157	·144	·176	·172	·180	·306	·295
15	·251	·289	·239	·327	·347	·126	·155	·197	·110	·157	·340	·224
16	·259	·270	·207	·245	·359	·115	·085	·171	·101	·171	·298	·160
17	·262	**·379**	·210	·222	·360	**·087**	**·068**	·175	·129	·226	·272	·201
18	·247	·335	**·205**	·232	·340	·115	·084	·172	·092	**·293**	·246	·224
19	·290	·293	·211	·242	·355	·190	·103	**·077**	·156	·219	·225	·286
20	·270	·266	·214	·232	·347	·222	·086	·169	·186	·234	**·212**	·259
21	·298	·238	·238	·223	·355	·207	·085	·178	·126	·246	·238	·215
22	·272	·236	·317	·231	·359	·194	·124	·144	·132	·236	·320	·221
23	·240	·220	**·418**	·254	·316	·183	·148	·171	·167	·120	·318	·209
24	·261	·304	·343	·336	·305	·198	·159	·188	·124	·112	·319	·224
25	·237	·228	·417	·324	·291	·213	·181	·203	·145	·120	·325	**·308**
26	·235	·208	·416	·304	·306	·226	·176	**·228**	·164	**·084**	**·374**	·260
27	**·178**	·189	·343	·293	·351	·239	·196	·226	·158	·090	·359	·245
28	·196	·208	·277	·329	**·387**	·254	·190	·210	·156	·122	·318	·263
29	·279		·236	·381	·353	·243	·209	·118	·124	·156	·300	·278
30	·299		·318	**·382**	·333	·221	·203	·113	·167	·165	·296	·233
31	·277		·256		·345		·174	·168		·264		·207
Monthly Mean.	0·259	0·267	0·285	0·273	**0·332**	0·201	0·154	0·173	**0·140**	0·178	0·299	0·241
Annual Variation	+ ·026	+ ·034	+ ·052	+ ·040	+ ·099	— ·032	— ·079	— ·060	— ·093	— ·055	+ ·066	+ ·008

	in.
Annual mean	0·233
The greatest mean daily additional capacity of the air in the year (that of 23rd March) was	0·418
The least do. do. do. (that of 17th July) was	0·068
Difference =	0·350

Maxima and Minima of different Meteorological Elements, 1894.

TABLE V.—*In which are collected the individual observations in each month of the year, which showed the greatest and the least values of the following elements, viz., Height of Barometer, corrected for Temperature; Temperature of Air; Pressure of Vapour; and Additional Capacity of Air.*

1894.	HEIGHT OF BAROMETER.			TEMPERATURE OF AIR.			PRESSURE OF VAPOUR.			ADDITIONAL CAPACITY.		
Month.	Greatest.	Least.	Range.	Greatest.	Least.	Range.	Greatest.	Least.	Range.	Greatest.	Least.	Range.
	in.	in.	in.	°	°	°	in.	in.	in.	in.	in.	in.
January...	30·050	29·793	0·257	86·2	66·8	19·4	0·832	0·432	0·400	0·651	0·082	0·569
February	·044	·737	·307	86·4	65·3	21·1	·853	·344	·509	·718	·074	·644
March ...	29·979	·727	·252	89·0	70·2	18·8	·914	·441	·473	·735	·090	·645
April ...	·920	·652	·268	89·3	75·2	14·1	·995	·657	·338	·617	·089	·528
May ...	·910	·653	·257	89·9	79·8	10·1	·952	·762	·190	·534	·155	·379
June ...	·780	·467	·313	90·4	75·9	14·5	1·087	·808	·279	·498	·053	·445
July ...	·790	·451	·339	87·1	75·3	11·8	0·985	·741	·244	·367	·042	·325
August ...	·856	·573	·283	85·1	74·5	10·6	·966	·748	·218	·352	·038	·314
September.	·877	·640	·237	84·2	74·3	9·9	·944	·773	·171	·329	·048	·281
October ...	·985	·631	·354	88·1	73·6	14·5	1·000	·615	·385	·541	·049	·492
November.	30·089	·737	·352	88·4	70·6	17·8	0·821	·480	·341	·812	·099	·713
December.	·094	·790	·304	86·5	65·1	21·4	·805	·431	·374	·727	·057	·670
Year ...	30·094	29·451	0·643	90·4	65·1	25·3	1·087	0·344	0·743	0·812	0·038	0·774

Rainfall, 1894.

TABLE VI.—*Total fall of rain (in inches) as measured by F. Chambers's Self-registering Gauge, the funnel of which is 28 feet above the ground.*

1894.	MONTH.											
Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	in.		in.			in.	in.	in.	in.	in.		
1	0·20						0·16	0·03				
2						0·23	0·12	0·12	0·36	0·13		
3							0·01	0·10	0·08	0·28		
4							0·03	0·08	0·17			
5							0·09	0·04	0·52	0·18		
6							0·41	0·13	0·26	0·02		
7						0·58	0·12	0·01	1·45			
8						0·26	0·51	0·19	0·42			
9						0·97	3·34	0·06	3·14	0·01		
10						2·15	2·91	0·07	0·82			
11						3·01	0·95	0·68	0·43			
12						2·76	0·59	0·56	0·42			
13						0·80	0·56	0·20	0·03	0·01		
14						1·11	0·18	0·11	0·22			
15						0·88	0·18		0·22			
16						0·50	2·53	0·19	0·38			
17						1·91	1·87	0·18	0·04			
18						0·17	0·71	0·11	0·38			
19							1·21	2·72		0·01		
20							2·12	0·10				
21			0·02				4·46	0·10	0·04			
22						0·01	0·91	0·68	0·47			
23						0·12	0·11	0·21	0·02	0·72		
24						0·10	0·05	0·11	0·73	0·35		
25						0·03	0·01	0·04	0·20	0·57		
26						0·07	0·03			0·28		
27						0·02	0·04	0·15		0·09		
28							0·05		0·05	0·01		
29			0·01			0·03	0·03	0·87	0·64			
30			0·02			0·14	0·05	0·03	0·01			
31							0·27					
Monthly Total.	0·20		0·05			15·85	24·61	7·87	11·50	2·66		
Number of rainy days.	1		3			21	31	27	25	13		

Total fall of rain in the year ... ... 62·74 inches.
Total number of rainy days in the year 121
The greatest daily fall of rain in the year (that of 21st July) was ... ... 4·46 inches.

No rain fell in the months of February, April, May, November, and December, nor on any of the days left blank in the above table.

Mean Daily Velocities of the North and East Components of the Wind, 1894.

TABLE VII.—*Showing the Mean Velocities of the North or South and East or West Components of the Winds which blew on each day of the year 1894.*

In Miles per Hour.

1894.	MONTH.																							
Date.	January.		February.		March.		April.		May.		June.		July.		August.		September.		October.		November.		December.	
	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.
1	2·1 S	1·1 E	9·6 N	3·9 W	10·1 N	7·5 W	5·8 N	6·5 W	0·9 N	7·9 W	3·8 N	11·0 W	7·7 S	17·4 W	0·3 S	17·6 W	2·5 N	4·2 W	0·5 N	4·7 W	6·5 N	2·2 E	5·5 N	1·9 E
2	6·6 N	0·1 E	9·3 N	1·3 W	8·8 N	7·5 W	3·7 N	6·4 W	2·9 N	8·2 W	2·2 N	11·0 W	6·6 S	16·7 W	0·4 S	15·9 W	3·5 N	4·9 W	2·1 S	5·4 W	6·4 N	0·4 W	3·5 N	3·0 E
3	9·1 N	1·7 W	8·2 N	0·1 E	9·5 N	4·8 W	6·4 N	4·0 W	5·6 N	8·4 W	1·8 N	11·5 W	6·3 S	14·8 W	1·0 N	14·7 W	0·5 S	12·6 W	5·1 S	0·2 E	0·2 N	3·9 W	3·7 N	0·2 W
4	12·6 N	2·9 W	5·3 N	0·6 E	5·8 N	2·6 W	5·2 N	5·2 W	4·2 N	7·1 W	3·2 N	10·0 W	7·0 S	17·6 W	2·6 S	17·8 W	4·1 S	9·3 W	4·8 S	1·7 W	7·7 N	1·3 W	5·0 N	2·2 W
5	8·7 N	1·3 W	3·0 N	0·6 W	6·5 N	5·1 W	3·2 N	8·1 W	0·3 N	6·5 W	2·5 N	9·2 W	6·7 S	15·0 W	6·6 S	19·5 W	5·0 S	13·7 W	8·4 S	0·4 W	7·3 N	1·4 W	4·6 N	0·5 W
6	6·5 N	1·6 E	1·6 N	5·2 W	3·8 N	5·5 W	6·4 N	5·7 W	2·4 S	5·8 W	0·7 S	6·9 W	4·2 S	12·7 W	4·4 S	17·2 W	0·9 S	12·6 W	8·6 S	0·8 W	6·0 N	0·5 W	7·7 N	2·6 W
7	7·6 N	0·1 E	11·1 N	4·7 W	9·6 N	6·4 W	0·8 S	6·3 W	4·4 S	5·9 W	1·8 N	4·2 W	3·1 S	15·3 W	0·3 S	11·1 W	2·3 N	8·2 W	1·2 S	0·7 W	6·4 N	1·2 E	8·3 N	3·8 W
8	7·1 N	0·2 E	8·5 N	4·6 W	9·2 N	4·3 W	1·9 S	4·2 W	8·7 S	6·8 W	9·0 S	0·7 W	6·2 S	21·3 W	1·1 N	9·1 W	3·7 S	3·3 W	7·7 S	3·1 W	7·4 N	2·1 E	5·4 N	0·7 E
9	4·4 N	0·8 E	8·7 N	2·4 W	11·4 N	3·2 W	1·4 S	4·0 W	8·1 S	7·0 W	20·5 S	4·1 E	5·0 S	22·6 W	0·6 S	9·7 W	6·0 N	7·0 W	5·8 N	2·3 W	5·0 N	5·3 E	3·8 S	1·1 E
10	4·8 N	1·0 E	4·0 N	0·9 W	10·9 N	7·7 W	1·3 N	4·5 W	4·3 S	6·9 W	14·0 S	0·2 E	9·0 S	19·0 W	4·6 S	14·5 W	2·3 S	1·1 E	0·3 N	1·0 E	1·1 N	1·0 E	3·1 N	0·5 E
11	3·2 N	0·8 E	2·4 N	0·4 E	10·5 N	3·8 W	3·8 N	4·9 W	1·8 N	8·2 W	6·3 S	6·3 W	1·0 S	16·3 W	8·5 S	16·5 W	4·0 S	0·6 W	3·0 N	0·4 E	3·3 N	0·8 E	8·1 N	2·9 W
12	1·5 N	0·4 E	5·2 N	0·5 W	2·7 N	1·8 W	8·1 N	6·9 W	8·4 N	10·0 W	9·6 S	10·8 W	2·8 N	17·0 W	6·6 S	18·5 W	0·5 S	9·7 W	8·1 N	2·1 W	4·2 N	4·3 E	7·6 N	1·8 W
13	4·2 N	0·9 E	2·4 N	0·1 E	5·1 N	5·4 W	8·7 N	6·5 W	6·6 N	8·5 W	8·4 S	16·1 W	0·4 N	15·7 W	3·7 S	20·2 W	0·2 N	13·0 W	2·3 N	0·9 W	5·5 N	3·3 E	11·7 N	2·5 W
14	4·2 N	0·7 E	6·0 N	2·0 W	13·5 N	5·5 W	10·6 N	6·9 W	3·4 N	6·4 W	5·8 S	15·5 W	2·5 S	11·3 W	1·3 S	17·4 W	1·7 N	12·0 W	1·3 S	4·0 E	5·8 S	2·6 E	8·0 N	0·2 E
15	5·5 N	2·2 W	1·7 N	2·0 W	1·5 S	3·9 W	8·4 N	6·8 W	3·4 N	8·0 W	6·3 S	16·8 W	1·9 N	11·6 W	0·5 S	16·8 W	1·9 N	7·4 W	1·1 N	0·9 E	5·6 N	6·7 E	6·2 N	1·0 W
16	5·0 N	1·8 W	7·6 N	2·3 W	0·7 N	4·3 W	7·0 N	8·8 W	3·1 N	8·0 W	3·2 S	16·1 W	2·4 N	7·6 W	1·6 S	16·5 W	5·2 N	8·7 W	2·3 N	0·1 W	6·7 N	0·4 E	4·5 N	0·5 W
17	3·5 N	1·2 W	11·2 N	2·7 W	2·0 S	4·0 W	3·6 N	5·8 W	4·9 N	9·1 W	2·9 S	9·0 W	2·0 S	7·0 W	2·3 S	16·7 W	5·7 N	6·6 W	5·6 N	0·6 W	8·2 N	1·3 W	5·8 N	0·8 W
18	4·5 N	1·5 W	7·8 N	4·0 W	0·7 N	2·9 W	2·4 N	5·9 W	4·3 N	8·1 W	8·1 S	3·3 W	6·2 S	5·9 W	1·0 S	16·3 W	2·6 N	4·6 W	4·7 N	3·4 E	5·9 N	0·5 W	2·4 N	1·9 E
19	5·4 N	1·0 W	6·2 N	3·5 W	7·1 S	4·3 W	3·9 N	6·3 W	5·7 N	9·6 W	6·1 S	7·3 W	4·8 S	22·6 W	1·9 S	13·2 W	4·6 N	6·0 W	5·0 N	2·6 E	3·3 N	0·4 W	1·8 N	1·3 E
20	4·9 N	0·8 W	7·0 N	3·8 W	4·5 S	2·5 W	1·6 S	5·6 W	1·8 S	7·7 W	2·8 S	12·4 W	3·7 S	33·3 W	0·2 N	13·8 W	4·7 N	6·3 W	4·3 N	3·9 E	3·8 N	0·3 E	3·5 N	0·4 E
21	4·6 N	0·3 E	3·0 N	1·8 W	14·8 N	0·5 W	0·2 S	5·8 W	2·5 S	8·2 W	4·4 S	14·4 W	8·2 S	29·1 W	0·6 N	9·6 W	1·1 S	3·3 W	7·7 N	0·3 E	6·1 N	0·9 W	4·2 N	0·3 W
22	4·5 N	1·2 W	1·1 N	2·2 W	9·2 N	6·9 W	0·8 S	5·0 W	0·4 S	7·8 W	5·4 S	10·9 W	10·9 S	25·6 W	1·1 S	10·0 W	3·4 S	0·3 W	2·9 N	2·5 E	6·5 N	5·9 E	3·5 N	0·1 E
23	9·8 N	2·3 W	5·1 N	3·4 W	14·8 N	7·2 W	3·6 S	5·0 W	1·8 N	7·5 W	6·0 S	13·6 W	11·4 S	11·7 W	1·5 S	8·9 W	4·7 S	2·9 W	3·5 S	3·6 E	4·1 N	2·3 E	3·1 N	0·9 W
24	10·0 N	2·9 W	8·5 N	5·1 W	15·4 N	8·9 W	2·7 S	5·9 W	4·1 N	9·3 W	6·1 S	13·0 W	6·8 S	10·7 W	2·9 S	12·9 W	10·7 S	2·1 E	18·0 S	4·4 E	6·1 N	5·7 E	7·6 N	0·1 W
25	5·2 N	0·1 W	4·8 N	4·8 W	13·8 N	7·6 W	1·5 N	5·6 W	3·1 N	7·8 W	6·7 S	15·0 W	5·9 S	14·9 W	0·8 S	12·1 W	7·1 S	1·0 E	21·0 S	8·7 E	5·8 N	4·4 E	12·5 N	3·2 W
26	1·8 S	0·7 W	0·4 N	4·2 W	10·3 N	5·9 W	7·7 S	4·4 W	0·5 S	7·9 W	5·5 S	15·8 W	5·9 S	14·5 W	0·0	11·7 W	4·4 S	0·3 W	25·8 S	4·9 E	5·3 N	6·5 E	9·4 N	1·9 W
27	4·9 N	2·9 W	4·9 N	5·4 W	8·8 N	5·5 W	6·4 S	5·3 W	0·5 S	8·2 W	2·5 S	16·6 W	5·7 S	14·2 W	0·3 N	10·7 W	1·2 N	1·5 W	5·4 S	1·6 W	5·8 N	5·4 E	7·3 N	0·2 W
28	9·6 N	2·8 W	7·4 N	4·2 W	0·5 S	5·5 W	2·8 S	6·8 W	0·3 S	7·6 W	5·8 S	17·9 W	4·6 S	14·8 W	0·3 N	9·3 W	1·3 N	2·7 W	6·3 S	0·9 E	6·4 N	4·2 E	2·8 N	1·4 E
29	12·8 S	4·4 W			1·8 N	3·9 W	2·2 S	6·3 W	1·5 N	7·9 W	6·3 S	14·8 W	6·0 S	13·5 W	0·4 S	2·2 W	2·8 S	3·8 W	1·0 N	0·8 W	5·2 N	4·1 E	3·4 N	0·3 W
30	11·6 N	5·3 W			5·9 N	1·8 W	1·9 S	8·0 W	2·0 N	7·2 W	7·5 S	17·5 W	7·1 S	8·9 W	0·3 S	2·0 E	1·8 N	8·5 W	6·3 N	2·0 W	6·0 N	0·9 W	4·0 N	0·4 E
31	11·2 N	4·4 W			7·9 N	4·5 W			4·3 N	9·0 W			5·0 S	15·4 W	0·9 N	2·2 W			7·3 N	1·6 E			3·6 N	0·1 E
Monthly Mean	6·1 N	1·1 W	5·8 N	2·7 W	6·1 N	4·9 W	1·9 N	5·8 W	1·2 N	7·8 W	4·8 S	10·8 W	4·9 S	16·0 W	1·6 S	12·9 W	0·0	5·7 W	1·2 S	0·6 E	5·8 N	1·9 E	5·3 N	0·4 W
Annual Variation	4·5 N	4·4 E	4·2 N	2·8 S	4·5 N	0·6 E	0·3 N	0·3 W	0·4 S	2·3 W	6·4 S	5·8 W	6·3 S	10·5 W	3·2 S	7·4 W	1·6 S	6·2 W	2·8 S	6·1 E	4·2 N	7·4 E	3·7 N	5·1 E

The Velocities of the Mean Components for the year are 1·6 N. and 5·8 W.

Velocity of Wind, 1894.

TABLE VIII.—*Mean Velocity of the Wind, in miles per hour, without regard to the direction from which it blew, for each Day of Bombay Civil Time: also the Mean Monthly Velocity, and its Variation from the Mean of the year.*

1894.	MONTH.											
Date.	January.	February.	March.	April.	May.	June.	July.	August.	September	October.	November	December.
	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.
1	8·3	11·1	14·0	9·3	8·2	12·0	19·1	17·7	6·3	6·6	11·4	9·9
2	10·2	11·3	13·0	8·1	9·1	11·7	18·0	16·0	8·3	7·0	9·5	9·0
3	11·5	10·5	13·5	8·7	11·1	12·0	16·1	15·4	12·7	8·4	11·7	6·5
4	14·2	7·2	8·2	9·5	9·5	11·0	19·0	18·4	10·5	7·1	10·4	7·5
5	10·2	6·2	9·2	7·6	10·2	9·7	17·0	20·8	**14·8**	9·9	9·5	7·1
6	9·7	5·7	8·6	10·2	7·9	**6·5**	13·7	18·1	12·8	9·9	9·5	10·0
7	10·0	**13·0**	12·5	6·8	7·9	8·2	16·0	11·1	9·5	7·2	9·2	10·0
8	9·8	10·1	12·3	**5·1**	11·5	11·9	22·8	9·8	8·4	10·0	11·0	8·4
9	7·8	9·8	13·1	6·5	11·2	**22·5**	23·6	9·8	10·7	8·7	10·6	8·4
10	8·5	7·1	14·3	6·5	8·4	16·9	21·4	15·5	6·6	6·0	6·2	8·2
11	8·7	5·9	12·9	9·3	8·9	11·3	16·5	18·8	7·6	8·1	8·0	9·7
12	6·9	7·5	7·4	13·0	**13·8**	18·1	17·5	19·9	12·4	10·0	10·0	9·7
13	7·0	**5·2**	7·8	**13·5**	11·5	18·8	16·2	**21·0**	13·0	8·1	9·8	12·4
14	8·2	8·7	15·3	13·5	8·9	17·5	11·8	17·9	12·5	7·4	10·5	11·1
15	8·4	5·0	7·7	11·3	8·7	18·3	12·0	16·9	8·9	**4·4**	12·0	8·4
16	7·0	10·1	6·0	12·2	8·6	16·7	11·2	17·0	11·3	6·2	8·9	8·0
17	**6·3**	12·8	6·4	8·4	10·7	12·3	**8·8**	17·2	9·7	8·0	10·0	8·0
18	7·7	10·0	7·5	7·3	9·5	10·7	10·0	16·5	7·9	9·2	8·5	8·4
19	7·8	7·9	10·6	8·6	11·6	10·0	24·0	14·2	8·4	8·4	**5·9**	**6·2**
20	8·0	9·0	8·3	6·4	8·2	13·0	**34·1**	13·9	8·0	8·1	8·5	6·2
21	7·5	5·8	**4·4**	6·4	8·7	15·2	30·7	9·8	**5·6**	9·8	8·1	6·3
22	6·7	6·9	12·3	6·7	8·0	12·4	27·9	10·5	7·3	8·4	12·1	6·3
23	11·2	9·3	17·1	9·1	8·0	15·0	16·4	9·4	7·1	6·7	10·0	8·0
24	11·3	10·6	**18·5**	10·4	10·3	14·5	13·0	12·7	11·7	19·6	**13·3**	9·9
25	7·8	8·1	16·4	9·5	8·6	16·5	16·2	12·3	7·7	22·9	12·7	**13·5**
26	6·6	6·2	12·7	11·2	8·0	17·0	15·8	11·7	7·7	**27·3**	13·0	10·5
27	8·7	8·7	11·7	10·5	8·2	17·0	15·3	10·7	9·3	7·1	12·5	9·8
28	11·6	9·9	7·3	8·7	**7·8**	19·1	15·7	9·6	8·4	6·8	12·1	9·2
29	**14·3**		6·3	7·5	8·3	16·4	14·8	6·5	9·7	7·5	11·7	7·9
30	13·9		10·2	8·6	8·5	19·0	15·7	6·2	9·0	8·7	8·4	7·5
31	13·3		10·8		10·3		16·5	**5·5**		9·4		7·3
Monthly Mean	9·3	**8·6**	10·9	9·0	9·4	14·4	**17·5**	13·9	9·5	9·5	10·2	8·7
Annual Variation	—1·6	—2·3	0·0	—1·9	—1·5	+3·5	+6·6	+3·0	—1·4	—1·4	—0·7	—2·2

	Miles.
The Mean Velocity for June to August	15·3
The Mean Velocity for September to May	9·5
The Mean Velocity for the year	10·9
The greatest monthly mean (that of July)	17·5
The least monthly mean (that of February)	8·6
Difference = ...	8·9
The greatest mean daily Velocity of Wind in the year (that of 20th July) was	34·1
The least do. do. do. (that of 21st March) was	4·4
Difference = ...	29·7

Aggregate and Mean Velocities and Relative Frequency of Different Winds, 1894.

TABLE IX.—*Showing, for the year 1894, the sums of the Velocities, and the Mean Velocities, in miles per hour, of the Winds which blew in each Month, from each of the sixteen Principal Directions: and also the number of hourly Observations which those sums comprise; the latter numbers indicating the Relative frequency of the same Wind (as to direction) in the several Months, and of different Winds during the same Month.*

1894.	N.			N.N.E.			N.E.			E.N.E.			E.			E.S.E.			S.E.			S.S.E.		
Month.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.
	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.
January ...	843	112	7·5	611	98	6·2	384	65	5·9	816	113	7·2	260	38	6·8	62	9	6·9	35	5	7·0	69	5	13·8
February ...	855	118	7·2	356	56	6·4	165	31	5·3	268	38	7·1	215	45	4·8	46	7	6·6	14	3	4·7	22	4	5·5
March ...	621	71	8·7	229	34	6·7	138	20	6·9	229	34	6·7	71	10	7·1	43	8	5·4	39	7	5·6	106	10	10·6
April ...	145	26	5·6	180	31	5·8	52	10	5·2	70	13	5·4	25	6	4·2	29	5	5·8	10	2	5·0	75	12	6·2
May ...	23	5	4·6	46	16	2·9	6	2	3·0	9	2	4·5	13	3	4·3	0	0	0·0	3	1	3·0	9	2	4·5
June... ...	14	1	14·0	0	0	0·0	24	6	4·0	0	0	0·0	4	1	4·0	20	3	7·0	112	13	8·6	681	35	19·5
July ...	8	1	8·0	0	0	0·0	7	1	7·0	0	0	0·0	0	0	0·0	12	1	12·0	5	1	5·0	41	6	6·8
August ...	11	2	5·5	4	1	4·0	12	2	6·0	10	2	5·0	28	4	7·0	62	9	6·9	12	1	12·0	40	6	6·7
September ...	86	15	5·7	34	7	4·9	19	3	6·3	23	4	5·7	158	21	7·5	140	21	6·7	177	23	7·7	354	43	8·2
October ...	166	23	7·2	226	38	5·9	396	61	6·5	619	91	6·8	228	37	6·2	294	31	9·5	201	26	7·7	1,403	91	15·4
November ...	592	80	7·4	318	54	5·9	628	79	7·9	1,529	146	10·5	949	85	11·2	224	24	9·3	5	1	5·0	0	0	0·0
December ...	850	111	7·7	463	77	6·0	335	50	6·7	882	113	7.8	398	62	6·4	143	19	7·5	62	9	6·9	23	2	11·5
Year ...	4,214	565	7·5	2,467	412	6·0	2,166	330	6·6	4,455	556	8·0	2,349	312	7·5	1,075	137	7·8	675	92	7·3	2,823	216	13·1

1894.	S.			S.S.W.			S.W.			W.S.W.			W.			W.N.W.			N.W.			N.N.W.			No. of Observations.		No. of hours.
Month.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Calm	Variable.	Record lost.
	Miles.		Miles.	Miles.		Miles.	Miles		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.			
January ...	20	2	10·0	0	0	0·0	10	2	5·0	63	7	9·0	112	14	8·0	620	64	9·7	1,547	118	13·1	1,497	92	16·3	0	0	0
February ...	0	0	0·0	0	0	0·0	11	2	5·5	23	7	3·3	118	16	7·4	938	112	8·4	1,548	148	10·5	1,174	84	14·0	1	0	0
March ...	159	14	11·4	158	22	7·2	164	26	6·3	85	12	7·1	458	57	8·0	666	78	8·5	3,068	211	14·5	1,843	130	14·2	0	0	0
April ...	344	28	12·3	298	38	7·8	248	46	5·4	490	57	8·6	1,058	127	8·3	1,587	151	10·5	1,427	111	12·9	452	53	8·5	4	0	0
May ...	33	3	11·0	327	25	13·1	427	43	9·9	858	105	8·2	1,434	176	8·2	2,744	265	10·4	869	76	11·4	163	20	8·1	0	0	0
June ...	500	28	17·9	276	22	12·5	679	59	11·5	5,166	322	16·0	1,788	133	13·4	934	83	11·3	130	12	10·8	10	1	10·0	0	1	0
July ...	33	3	11·0	68	9	7·6	1,066	81	13·2	7,789	429	18·2	3,473	175	19·8	472	31	15·2	49	6	8·2	0	0	0·0	0	0	0
August ...	25	5	5·0	8	2	4·0	172	13	13·2	3,396	208	16·3	5,943	418	14·2	480	48	10·0	65	7	9·3	75	16	4·7	0	0	0
September ...	451	41	11·0	168	27	6·2	137	26	5·3	707	64	11·0	1,934	170	11·4	1,396	136	10·3	739	92	8·0	290	27	10·7	0	0	0
October ...	1,002	67	15·0	270	40	6·7	83	15	5·5	230	29	7·9	227	33	6·9	406	45	9·0	654	61	10·7	631	56	11·3	0	0	0
November ...	0	0	0·0	0	0	0·0	0	0	0·0	13	2	6·5	55	8	6·9	371	45	8·2	1,047	89	11·8	1,589	107	14·9	0	0	0
December ...	16	1	16·0	10	1	10·0	15	2	7·5	41	4	10·2	139	21	6·6	597	64	9·3	1,201	114	10·5	1,289	94	13·7	0	0	0
Year ...	2,583	192	13·5	1,583	186	8·5	3,012	315	9·6	18,861	1,246	15·1	16,739	1,348	12·4	11,211	1,122	10·0	12,344	1,045	11·8	9,013	680	13·3	5	1	0

Temperature of the Ground, 1894.

TABLE X.—*Showing, for each Month, the Mean Temperature of the Ground, and its Annual Variation, at the respective depths of 1, 9, 20, 60 and 132 inches below the surface.*

Depth.	1 Inch.		9 Inches.		20 Inches.		60 Inches.		132 Inches.	
Month.	Mean Temperature.	Excess over the yearly Mean.	Mean Temperature.	Excess over the yearly Mean.	Mean Temperature.	Excess over the yearly Mean.	Mean Temperature.	Excess over the yearly Mean.	Mean Temperature.	Excess over the yearly Mean.
	°	°	°	°	°	°	°	°	°	°
January ...	77·4	—4·2	77·9	—3·7	80·8	—2·9	83·2	—1·2	82·8	—0·8
February ...	78·9	—2·7	78·7	—2·9	80·8	—2·9	82·6	—1·8	82·5	—1·1
March	81·6	0·0	80·9	—0·7	82·0	—1·7	82·8	—1·6	82·4	—1·2
April	84·7	+3·1	83·7	+2·1	84·6	+0·9	84·1	—0·3	82·8	—0·8
May	86·8	+5·2	85·8	+4·2	86·6	+2·9	85·5	+1·1	83·5	—0·1
June	84·6	+3·0	85·1	+3·5	87·1	+3·4	86·6	+2·2	84·3	+0·7
July	82·1	+0·5	83·0	+1·4	85·7	+2·0	86·5	+2·1	85·0	+1·4
August... ...	82·1	+0·5	82·6	+1·0	84·9	+1·2	85·5	+1·1	84·9	+1·3
September ...	80·7	—0·9	81·3	—0·3	83·6	—0·1	84·6	+0·2	84·3	+0·7
October ...	82·0	+0·4	82·0	+0·4	83·8	+0·1	84·3	—0·1	84·0	+0·4
November ...	80·1	—1·5	80·2	—1·4	82·7	—1·0	84·1	—0·3	83·5	—0·1
December ...	77·7	—3·9	78·4	—3·2	81·4	—2·3	83·5	—0·9	83·2	—0·4
Year ...	81·6		81·6		83·7		84·4		83·6	

Extent of Cloudy Sky, 1894.

TABLE XI.—*Means of Estimations made at 6, 10, 14, 16 and 22 hours daily, the whole Sky being reckoned as 10.*

1894.	MONTH:											
Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1	2·2		0·4		3·6	0·6	8·6	7·8	8·0	7·8	4·0	
2			3·0		2·6	3·4	9·0	9·8	9·2	5·6	5·0	
3			2·4		3·4	4·4	8·0	9·6	8·2	6·6	1·4	
4		0·2	1·6	0·6	0·4	2·0	8·4	9·6	5·0	5·6		3·4
5		0·6	2·8	5·0	0·2	4·2	8·4	10·0	9·0	6·8	0·4	0·4
6	0·6	2·2	1·2	5·4	2·2	7·4	8·2	9·2	8·2	7·0	1·4	
7	0·6	0·4	1·8	3·8	2·0	9·4	9·6	8·8	9·4	1·6		
8		1·6		6·8	3·6	8·6	10·0	10·0	10·0	3·6		0·4
9				1·4	1·8	10·0	10·0	9·0	10·0	5·0		0·8
10					2·8	10·0	10·0	9·4	10·0	4·0		1·6
11					2·0	10·0	10·0	9·2	10·0	4·6		5·8
12	0·4			0·2	2·0	10·0	10·0	9·8	9·2	6·0	1·2	1·4
13	0·4			3·0	0·8	10·0	9·2	10·0	4·6	3·4		0·4
14	0·6			0·2	3·2	10·0	8·6	9·0	9·6	5·4		
15	2·2	0·8	1·6		0·6	10·0	8·0	9·6	10·0	7·2		0·8
16			2·8		2·0	10·0	10·0	9·8	10·0	2·4	0·2	1·4
17			3·2	4·0	2·9	10·0	10·0	10·0	9·4	1·6	3·6	2·6
18	0·6		0·6	0·8	0·8	9·6	9·8	9·0	10·0	1·6	7·0	
19	0·2	1·2	1·0	1·2	0·8	5·4	10·0	10·0	7·6	5·6	4·0	
20			9·2	1·0	2·2	9·0	10·0	8·4	5·2	7·8	0·4	4·2
21			10·0	0·8	1·4	10·0	10·0	9·6	7·6	7·6		5·0
22			2·6	3·0	1·2	9·8	10·0	10·0	7·2	9·6		0·2
23		0·6	0·2	3·0	4·0	9·4	9·4	10·0	3·4	8·4		0·6
24			0·2	1·8	5·4	8·8	7·2	7·2	7·0	10·0		2·2
25				2·4	3·0	9·6	6·8	6·8	8·8	10·0		
26	0·4	0·6		0·6	3·8	8·6	7·4	5·8	7·6	8·8	0·4	
27		1·2		2·0	5·4	8·8	5·2	6·0	8·0	7·0	0·2	
28	1·6	1·4	2·2	1·0	1·0	9·0	5·6	7·2	9·8	3·0	1·8	
29			6·2	0·6	3·0	7·6	6·8	10·0	9·2	1·2	3·6	
30			5·6	2·2	1·0	9·2	7·2	9·0	10·0	1·0		
31			1·6		2·0		6·4	7·0		6·0		
Monthly Mean.	0·3	0·4	1·9	1·7	2·2	8·2	8·6	8·9	8·4	5·5	1·2	1·0
Annual Variation. ...	—3·7	—3·6	—2·1	—2·3	—1·8	+4·2	+4·6	+4·9	+4·4	+1·5	—2·8	—3·0

For the days which have no entry, 0·0 is to be understood.

Mean of the months from January to April, November and December ... ... 1·1

Mean of the months from May to October ... ... 7·0

Mean for the year ... ... 4·0

Rainfall, 1894.

TABLE XII.—*Total Fall of Rain (in inches) as measured by Newman's Gauge, placed 4½ feet above the ground.*

1894.	MONTH.											
Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	in.		in.	in.		in.	in.	in.	in.	in.		in.
1	0·22						0·16	0·05				
2						0·23	0·12	0·12	0·38	0·14		
3							0·01	0·10	0·09	0·30		
4							0·06	0·10	0·18			
5							0·09	0·04	0·56	0·19		
6							0·46	0·16	0·28	0·03		
7						0·59	0·13	0·02	1·51			
8						0·29	0·53	0·20	0·44			
9						1·14	3·53	0·07	3·24	0·01		
10						2·30	3·09	0·08	0·83			
11						3·14	1·01	0·72	0·43			0·01
12						2·92	0·64	0·59	0·43			
13				0·01		0·83	0·65	0·20	0·04	0·01		
14						1·16	0·19	0·14	0·25			
15						0·97	0·19		0·23			
16						0·52	2·65	0·20	0·39			
17						2·02	1·94	0·20	0·05			
18						0·19	0·70	0·42	0·39			
19							1·28	2·86		0·02		
20							2·27	0·10				
21			0·02				4·77	0·11	0·07			
22						0·01	1·00	0·71	0·47			
23						0·13	0·11	0·22	0·03	0·83		
24						0·10	0·06	0·11	0·76	0·38		
25						0·04	0·02	0·04	0·22	0·67		
26						0·07	0·03			0·38		
27						0·03	0·05	0·16		0·11		
28							0·05	0·01	0·06	0·01		
29			0·02			0·03	0·03	0·93	0·70			
30			0·02			0·16	0·06	0·04	0·01			
31							0·28					
Monthly Total	0·22		0·06	0·01		16·87	26·16	8·40	12·04	3·08		0·01
Number of rainy days	1		3	1		21	31	28	25	13		1

Total fall of rain in the year ... ... 66·85 inches.
Total number of rainy days in the year 124
The greatest daily fall of rain in the year (that of 21st July) was ... ... 4·77 inches.
No rain fell in the months of February, May, and November, nor on any of the days left blank in the above table.

Table XIII.—Five-day Means, 1894.

Number of Five-day Period.	Barometric Pressure.	Temperature of the Air.	Pressure of Vapour.	Additional Capacity of the Air.	*Rainfall.	North or South Component of Wind.	East or West Component of Wind.	Number of Five-day Period.	Barometric Pressure.	Temperature of the Air.	Pressure of Vapour.	Additional Capacity of the Air.	*Rainfall.	North or South Component of Wind.	East or West Component of Wind.
	In.	°	In.	In.	In.	Miles.	Miles.		In.	°	In.	In.	In.	Miles.	Miles.
1	29·905	74·0	0·594	0·250	0·22	7·0 N.	0·9 W.	38	29·635	81·4	0·900	0·173	4·74	5·0 S.	17·5 W.
2	·950	76·0	·644	·261		6·0 N.	0·7 E.	39	·673	79·8	·905	·113	5·58	1·9 S.	15·9 W.
3	·933	75·1	·603	·273		3·7 N.	0·1 E.	40	·641	78·8	·887	·099	6·76	1·9 S.	10·9 W.
4	·904	74·8	·603	·266		4·7 N.	1·3 W.	41	·588	79·7	·894	·120	8·21	8·2 S.	22·1 W.
5	·917	75·5	·626	·262		6·8 N.	1·2 W.	42	·703	81·3	·880	·190	0·18	5·6 S.	14·4 W.
6	·950	75·3	·645	·237		7·4 N.	3·2 W.	43	·726	81·3	·890	·177	0·61	2·4 S.	14·5 W.
7	·955	73·5	·519	·316		8·7 N.	1·8 W.	44	·646	81·5	·893	·183	0·52	2·6 S.	14·9 W.
8	·939	76·9	·699	·230		6·6 N.	3·5 W.	45	·666	81·0	·885	·173	1·66	4·8 S.	15·9 W.
9	·942	78·0	·697	·270		4·0 N.	0·6 W.	46	·658	80·7	·869	·178	0·66	1·3 S.	16·7 W.
10	·928	77·4	·633	·313		6·9 N.	2·9 W.	47	·674	79·4	·857	·148	4·00	0·7 S.	11·1 W.
11	·878	76·1	·652	·253		4·9 N.	3·3 W.	48	·785	80·9	·844	·211	0·32	0·6 S.	11·2 W.
12	·865	77·4	·734	·210		5·5 N.	5·2 W.	49	·745	78·4	·828	·145	1·35	1·2 N.	2·3 W.
13	·837	77·4	·710	·232		6·9 N.	5·1 W.	50	·753	79·7	·867	·147	2·62	1·6 S.	11·3 W.
14	·869	77·1	·624	·312		10·3 N.	5·1 W.	51	·746	78·3	·864	·105	5·37	1·0 N	3·9 W.
15	·855	79·1	·706	·295		4·1 N.	4·2 W.	52	·743	78·9	·847	·143	0·96	2·9 N.	9·5 W.
16	·837	81·1	·848	·216	0·02	2·9 S.	2·8 W.	53	·786	78·7	·847	·138	0·93	1·5 N.	4·1 W.
17	·865	81·6	·702	·382		12·7 N.	7·3 W.	54	·751	78·9	·837	·152	1·01	5·1 S.	0·3 W.
18	·871	80·9	·771	·286	0·04	4·8 N.	4·2 W.	55	·798	79·4	·848	·158	0·91	0·3 S.	5·0 W.
19	·836	80·8	·812	·243		4·9 N.	5·4 W.	56	·844	78·4	·796	·178	0·52	5·6 S.	0·7 W.
20	·810	81·4	·815	·259		0·7 N.	4·9 W.	57	·827	81·6	·898	·183	0·01	5·0 N.	1·0 W.
21	·804	82·8	·835	·290	0·01	7·9 N.	6·4 W.	58	·800	81·2	·886	·184	0·01	2·0 N.	0·7 E.
22	·765	82·2	·869	·235		3·1 N.	6·5 W.	59	·748	82·1	·854	·246	0·02	4·9 N.	2·5 E.
23	·754	84·2	·904	·274		1·2 S.	5·5 W.	60	·735	78·6	·874	·105	2·37	14·7 S.	4·0 E.
24	·755	83·5	·814	·338		4·2 S.	6·2 W.	61	·887	78·9	·796	·195	0·01	3·0 N.	0·4 E.
25	·815	83·6	·851	·303		2·8 N.	7·6 W.	62	·847	77·6	·652	·299		7·5 N.	1·5 W.
26	·774	84·5	·852	·337		5·6 S.	6·5 W.	63	·952	78·2	·673	·299		4·6 N.	2·1 E.
27	·816	83·9	·840	·324		4·7 N.	8·2 W.	64	·984	77·9	·643	·321		5·6 N.	3·5 E.
28	·816	84·7	·842	·352		3·2 N.	8·5 W.	65	·960	78·2	·730	·239		5·5 N.	0·5 W.
29	·774	85·0	·881	·325		1·2 N.	8·1 W.	66	·971	78·8	·660	·331		5·6 N.	5·0 E.
30	·720	85·3	·872	·346		0·4 N.	7·8 W.	67	·900	77·0	·622	·313		5·8 N.	2·9 E.
31	·720	86·3	·936	·323	0·23	3·1 N.	10·5 W.	68	·895	76·0	·680	·221		4·9 N.	0·5 W.
32	·640	83·8	·934	·229	2·02	5·2 S.	3·2 W.	69	·926	76·4	·673	·241	0·01	4·2 N.	0·7 W.
33	·595	79·9	·902	·119	10·35	8·8 S.	9·7 W.	70	·929	78·1	·573	·246		7·6 N.	1·1 W.
34	·565	81·1	·939	·127	3·70	5·3 S.	10·5 W.	71	·979	76·8	·690	·236		3·5 N.	0·5 E.
35	·643	83·4	·943	·201	0·24	4·9 S.	12·9 W.	72	·983	74·9	·626	·244		7·2 N.	1·2 W.
36	·662	83·7	·920	·235	0·17	5·4 S.	16·0 W.	73	·963	75·4	·641	·245		4·2 N.	0·2 E.
37	·684	83·0	·901	·228	0·51	7·0 S.	16·8 W.								

* Five-day sums, not means.

TABLES OF RESULTS

OF

ABSOLUTE MAGNETICAL OBSERVATIONS,

1894.

B 983—1

Absolute Magnetical Observations.—Table I.

Observations of Vibration and Deflection, taken with the Kew Unifilar Magnetometer (No. 23, by Elliott Brothers), for the determination of Absolute Horizontal Force.

1894.

1894. Date.	Civil Time, Mean.	Magnet N. 23 *a*. Time of one Vibration.	Effect of 90° Torsion.	Temperature.	Rate of Chronometer.	Corresponding Mean Reading of L. H. F. Magnetometer. Scale Reading.	Thermometer.	Angle of Deflection of Magnet N. 23 *c* by N. 23 *a* at Distance. 0·8 foot.	1·0 foot.	Temperature.	Corresponding Mean Reading of L. H. F. Magnetometer. Scale Reading.	Thermometer.	Observer.	Calculated Results in English Units. Values of m.	Values of X. From Deflections at distance. 0·8 foot ($X_{0\cdot8}$)	1·0 foot ($X_{1\cdot0}$)	Difference. $X_{0\cdot8}-X_{1\cdot0}$	Mean. $\frac{X_{0\cdot8}+X_{1\cdot0}}{2}$	Monthly Mean Values of X.	Monthly Mean Values of X in Metrical Units.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
	h. m.	s.	Sc. div.	°	s.		°	° ′ ″	° ′ ″	°		°								
JANUARY 3	12 14	2·8435	0·66	83·0	+12·4	15·46	79·1	17 29 27	8 53 22	81·9	15·48	79·6	V.G.G.	·63668	8·1090	8·1085	+·0005	8·1087		
„ „	15 20	2·8425	0·64	81·9	„	15·53	80·2	17 29 5	8 53 10	82·7	15·49	80·1	V.G.G.	·63669	8·1117	8·1111	+·0006	8·1114		
„ 10	12 13	2·8420	0·68	85·4	+11·4	16·34	86·1	17 28 7	8 52 37	84·4	16·15	80·5	D.	·63681	8·1178	8·1180	−·0002	8·1179		
„ „	15 23	2·8431	0·64	84·4	„	15·39	82·9	17 28 17	8 52 42	86·4	15·82	81·6	D.	·63688	8·1115	8·1115	·0000	8·1115		
„ 17	12 12	2·8412	0·72	83·9	− 0·6	16·77	79·3	17 27 20	8 52 17	83·7	16·48	79·6	V.G.G.	·63649	8·1214	8·1210	+·0004	8·1212	8·1148	3·7416
„ „	15 26	2·8417	0·68	82·8	„	16·07	80·9	17 27 10	8 52 13	84·6	16·25	80·8	V.G.G.	·63652	8·1188	8·1182	+·0006	8·1185		
„ 24	12 11	2·8412	0·73	82·4	− 0·9	16·61	79·5	17 27 17	8 52 15	82·6	16·25	80·6	D.	·63631	8·1212	8·1208	+·0004	8·1210		
„ „	15 35	2·8422	0·65	81·7	„	15·54	81·9	17 28 35	8 53 00	82·4	15·73	81·6	D.	·63660	8·1132	8·1120	+·0012	8·1126		
„ 31	12 8	2·8418	0·70	79·9	0·0	16·47	77·6	17 28 42	8 53 5	79·8	16·40	78·0	V.G.G.	·63636	8·1147	8·1133	+·0014	8·1140		
„ „	15 21	2·8413	0·72	77·9	„	16·12	79·5	17 29 10	8 53 17	80·5	16·17	78·8	V.G.G.	·63647	8·1119	8·1107	+·0012	8·1113		
FEBRUARY 7	12 23	2·8417	0·60	83·1	− 0·9	15·89	81·5	17 28 36	8 53 2	83·7	15·43	82·1	G.S.G.	·63668	8·1147	8·1133	+·0014	8·1140		
„ „	15 24	2·8429	0·51	82·4	„	15·09	83·2	17 28 34	8 52 59	84·6	15·16	82·9	G.S.G.	·63660	8·1100	8·1089	+·0011	8·1094		
„ 14	12 10	2·8416	0·61	87·0	− 1·0	16·35	82·7	17 26 5	8 51 47	86·6	16·40	83·3	V.G.G.	·63669	8·1249	8·1236	+·0013	8·1242		
„ „	15 25	2·8430	0·61	84·9	„	15·52	84·9	17 26 37	8 52 0	86·9	15·70	84·6	V.G.G.	·63639	8·1169	8·1160	+·0009	8·1164	8·1127	3·7406
„ 21	12 24	2·8433	0·63	83·9	− 0·3	15·43	80·1	17 29 45	8 53 32	83·9	14·97	80·8	G.S.G.	·63672	8·1062	8·1055	+·0007	8·1058		
„ „	15 24	2·8438	0·61	84·4	„	14·92	82·1	17 29 29	8 53 26	84·3	14·91	81·7	G.S.G.	·63672	8·1059	8·1049	+·0010	8·1054		
„ 28	12 10	2·8426	0·62	84·7	− 0·4	15·73	81·3	17 27 37	8 52 35	84·4	15·66	81·9	V.G.G.	·63653	8·1163	8·1147	+·0016	8·1155		
„ „	15 25	2·8432	0·65	83·6	„	15·14	82·6	17 27 55	8 52 45	85·4	15·25	82·3	V.G.G.	·63652	8·1115	8·1098	+·0017	8·1106		
MARCH 7	13 7	2·8416	0·59	82·1	− 0·2	16·12	80·7	17 27 45	8 52 38	82·0	15·86	81·1	D.	·63636	8·1190	8·1175	+·0015	8·1182		
„ „	15 38	2·8428	0·55	81·3	„	15·41	81·9	17 28 7	8 52 52	81·5	15·60	81·4	D.	·63625	8·1137	8·1120	+·0017	8·1128		
„ 14	12 7	2·8410	0·61	84·2	− 0·9	17·23	81·6	17 25 42	8 51 37	85·2	16·67	82·4	V.G.G.	·63614	8·1270	8·1257	+·0013	8·1263		
„ „	15 24	2·8435	0·61	85·9	„	15·65	83·9	17 26 8	8 51 47	86·3	15·91	83·3	V.G.G.	·63618	8·1188	8·1176	+·0012	8·1182		
„ 21	12 15	2·8426	0·61	86·8	− 1·2	16·01	84·9	17 25 42	8 51 32	87·1	15·81	84·4	V.G.G.	·63614	8·1227	8·1219	+·0008	8·1223		
„ „	15 23	2·8437	0·59	88·0	„	15·07	84·9	17 25 50	8 51 37	88·4	15·38	84·6	V.G.G.	·63637	8·1191	8·1182	+·0009	8·1186	8·1197	3·7438
„ 28	12 10	2·8425	0·61	87·9	− 0·9	16·13	84·4	17 25 37	8 51 30	88·4	15·93	84·9	V.G.G.	·63639	8·1233	8·1223	+·0010	8·1228		
„ „	15 19	2·8435	0·63	87·7	„	15·24	85·6	17 25 47	8 51 35	89·0	15·53	85·1	V.G.G.	·63640	8·1191	8·1182	+·0009	8·1186		

1894. Date.	Civil Time, Mean.	Magnet N. 23 a. Time of one Vibration.	Effect of 90° Torsion.	Temperature.	Rate of Chronometer.	Corresponding Mean Reading of L. H. F. Magnetometer. Scale Reading.	Thermometer.	Angle of Deflection of Magnet N. 23 c by N. 23 a at Distance. 0·8 foot.	1·0 foot.	Temperature.	Corresponding Mean Reading of L. H. F. Magnetometer. Scale Reading.	Thermometer.	Observer.	Calculated Results in English Units. Values of m.	Values of X. From Deflections at distance. 0·8 foot ($X_{0\cdot8}$)	1·0 foot ($X_{1\cdot0}$)	Difference. $X_{0\cdot8}-X_{1\cdot0}$	Mean. $\frac{X_{0\cdot8}+X_{1\cdot0}}{2}$	Monthly Mean Values of X.	Monthly Mean Values of X in Metrical Units.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
	h. m.	s.	Sc. div.	°	s.		°	° ′ ″	° ′ ″	°		°								
April 4	12 7	2·8418	0·67	87·0	−0·8	16·18	84·0	17 25 35	8 51 30	87·6	16·00	84·5	N.	·63643	8·1253	8·1242	+·0011	8·1247		
„ „	15 11	2·8438	0·64	87·4	„	15·07	85·2	17 26 12	8 51 45	88·2	15·39	85·0	N.	·63640	8·1171	8·1165	+·0006	8·1168		
„ 11	12 12	2·8425	0·58	88·7	−0·1	15·83	84·8	17 25 42	8 51 27	88·9	15·77	85·2	N.	·63655	8·1233	8·1231	+·0002	8·1232		
„ „	15 15	2·8437	0·61	88·9	„	15·16	86·3	17 26 10	8 51 40	89·8	15·40	85·9	N.	·63656	8·1175	8·1175	·0000	8·1175		
„ 18	12 27	2·8454	0·59	89·8	−0·7	13·82	85·7	17 27 45	8 52 30	90·0	13·85	86·0	D.	·63669	8·1072	8·1068	+·0004	8·1070	8·1173	3·7427
„ „	15 39	2·8445	0·60	88·1	„	13·67	87·0	17 27 42	8 52 27	90·1	13·70	86·7	D.	·63671	8·1083	8·1079	+·0004	8·1081		
„ 25	12 6	2·8430	0·64	92 0	−0·6	15·15	87·6	17 25 15	8 51 10	91·8	14·98	87·9	N.	·63663	8·1236	8·1238	−·0002	8·1237		
„ „	15 21	2·8439	0·60	90·2	„	14·34	89·0	17 25 42	8 51 20	92·7	14·45	88·8	N.	·63660	8·1171	8·1178	−·0007	8·1174		
May 2	12 16	2·8422	0·62	91·4	+0·4	15·24	87·1	17 25 10	8 51 6	91·6	14·92	87·4	D.	·63666	8·1261	8·1264	−·0003	8·1262		
„ „	15 28	2·8438	0·61	89·9	„	14·40	88·3	17 25 17	8 51 10	91·7	14·70	88·0	D.	·63652	8·1195	8·1199	−·0004	8·1197		
„ 9	12 9	2·8431	0·66	91·8	−0·5	15·40	88·0	17 24 32	8 50 51	92·0	15·30	88·3	V. G. G.	·63646	8·1255	8·1255	·0000	8·1255		
„ „	15 17	2·8435	0·65	91·2	„	14·67	89·3	17 24 37	8 50 55	93·4	14·93	89·0	V. G. G.	·63659	8·1223	8·1221	+·0002	8·1222		
„ 16	12 37	2·8429	0·57	92·0	−0·4	15·02	88·1	17 25 10	8 51 13	92·1	14·83	88·6	D.	·63671	8·1240	8·1236	+·0004	8·1238	8·1213	3·7446
„ „	15 38	2·8459	0·63	91·2	„	14·17	89·3	17 25 50	8 51 32	92·3	14·27	89·0	D.	·63625	8·1120	8·1117	+·0003	8·1118		
„ 23	12 12	2·8431	0·67	92·3	−0·9	15·29	88·6	17 24 20	8 50 50	92·8	15·03	89·2	V. G. G.	·63644	8·1261	8·1253	+·0008	8·1257		
„ „	15 22	2·8447	0·64	92·0	„	14·28	90·2	17 24 52	8 51 2	93·1	14·59	90·1	V. G. G.	·63646	8·1188	8·1186	+·0002	8·1187		
„ 30	12 20	2·8443	0·58	93·6	−0·1	15·05	89·5	17 24 20	8 50 47	93·9	14·89	89·9	D.	·63637	8·1229	8·1225	+·0004	8·1227		
„ „	15 13	2·8453	0·63	93·6	„	14·30	91·0	17 24 55	8 51 7	94·5	14·47	90·5	D.	·63647	8·1171	8·1165	+·0006	8·1168		
June 6	12 20	2·8437	0·58	92·6	−0·8	15·01	90·0	17 23 25	8 50 20	95·1	14·88	90·3	N.	·63628	8·1261	8·1257	+·0004	8·1259		
„ „	15 14	2·8454	0·57	93·3	„	14·38	91·0	17 24 5	8 50 40	95·1	14·65	90·7	N.	·63628	8·1193	8·1190	+·0003	8·1191		
„ 13	12 28	2·8432	0·38	83·9	+0·3	15·80	81·8	17 26 15	8 51 51	84·6	15·75	82·0	D.	·63597	8·1193	8·1182	+·0011	8·1187		
„ „	15 50	2·8443	0·42	83·9	„	15·06	82·7	17 26 55	8 52 7	84·9	15·50	82·6	D.	·63614	8·1133	8·1126	+·0007	8·1129	8·1205	3·7442
„ 20	12 5	2·8443	0·37	90·0	0·0	15·52	85·6	17 24 20	8 50 50	90·0	15·59	85·9	V. G. G.	·63600	8·1238	8·1231	+·0007	8·1234		
„ „	15 28	2·8454	0·36	89·4	„	14·27	86·6	17 24 57	8 51 7	90·6	14·75	86·3	V. G. G.	·63609	8·1173	8·1167	+·0006	8·1170		
„ 27	12 10	2·8425	0·38	89·0	−0·5	15·71	86·1	17 24 5	8 50 37	90·2	15·60	86·5	D.	·63617	8·1289	8·1289	·0000	8·1289		
„ „	15 28	2·8453	0·43	89·9	„	14·66	87·2	17 24 45	8 50 57	90·9	14·98	87·0	D.	·63600	8·1182	8·1182	·0000	8·1182		
July 4	12 17	2·8434	0·38	89·5	−0·5	15·05	85·8	17 25 52	8 51 30	88·4	14·88	86·0	V. G. G.	·63634	8·1216	8·1216	·0000	8·1216		
„ „	15 23	2·8460	0·37	88·4	„	14·18	86·5	17 26 20	8 51 42	89·3	14·45	86·2	V. G. G.	·63608	8·1107	8·1111	−·0004	8·1109		
„ 11	12 26	2·8412	0·33	81·7	+0·7	16·17	81·7	17 27 11	8 52 10	81·6	15·99	81·3	D.	·63618	8·1227	8·1227	·0000	8·1227		
„ „	15 27	2·8434	0·32	82·0	„	15·18	81·5	17 27 45	8 52 30	81·7	15·51	81·3	D.	·63617	8·1145	8·1139	+·0006	8·1142		
„ 18	12 13	2·8433	0·34	83·6	+0·5	15·65	81·3	17 26 40	8 51 52	83·6	15·70	81·5	V. G. G.	·63597	8·1184	8·1188	−·0004	8·1186	8·1162	3·7422
„ „	15 27	2·8446	0·33	83·4	„	14·66	82·0	17 27 47	8 52 30	84·2	14·96	82·0	V. G. G.	·63618	8·1098	8·1094	+·0004	8·1096		
„ 25	12 4	2·8437	0·34	85·9	+0·3	15·35	82·8	17 26 22	8 51 52	86·2	15·19	83·1	D.	·63609	8·1180	8·1171	+·0009	8·1175		
„ „	15 37	2·8443	0·41	86·0	„	14·43	83·8	17 26 32	8 51 56	87·1	14·83	83·7	D.	·63631	8·1147	8·1139	+·0008	8·1143		

August	1	12	9	2·8430	0·42	86·2	0·0	15·57	84·0	17	24	55	8	51	5	87·0	15·53	84·2	N.	·63592	8·1246	8·1242	+·0004	8·1244	8·1149	3·7416
	„	„	15	18	2·8440	0·35	86·7	„	14·79	84·8	17	25	15	8	51	15	87·0	15·17	84·7	N.	·63602	8·1212	8·1206	+·0006	8·1209		
	„	8	12	23	2·8428	0·42	87·0	+0·5	15·64	84·2	17	24	50	8	51	7	87·5	15·45	84·6	D.	·63599	8·1257	8·1247	+·0010	8·1252		
	„	„	15	54	2·8440	0·38	86·4	„	14·76	85·2	17	25	35	8	51	25	88·5	14·99	85·2	D.	·63614	8·1182	8·1178	+·0004	8·1180		
	„	15	12	11	2·8443	0·33	85·9	+0·1	14·65	83·4	17	26	30	8	51	55	86·6	14·60	83·6	N.	·63606	8·1152	8·1145	+·0007	8·1148		
	„	„	15	14	2·8454	0·42	84·9	„	14·35	83·4	17	27	10	8	52	12	86·7	14·15	83·9	N.	·63589	8·1087	8·1083	+·0004	8·1085		
	„	22	12	13	2·8451	0·37	85·4	+1·3	14·41	82·8	17	27	30	8	52	27	85·0	14·49	82·8	D.	·63609	8·1104	8·1092	+·0012	8·1098		
	„	„	15	38	2·8454	0·41	83·4	„	14·07	83·0	17	28	15	8	52	47	85·6	14·22	83·3	D.	·63621	8·1044	8·1036	+·0008	8·1040		
	„	29	12	10	2·8441	0·41	85·7	+1·2	15·06	82·0	17	27	25	8	52	27	83·4	15·06	82·0	N.	·63618	8·1152	8·1139	+·0013	8·1145		
	„	„	15	22	2·8446	0·37	83·4	„	14·69	82·0	17	27	40	8	52	30	84·8	14·87	82·0	N.	·63615	8·1096	8·1089	+·0007	8·1092		
Sept.	5	12	48	2·8431	0·38	86·2	+1·0	15·37	83·3	17	26	30	8	51	57	84·6	15·26	83·2	D.	·63618	8·1208	8·1199	+·0009	8·1203	8·1135	3·7410
	„	„	15	51	2·8442	0·37	82·9	„	14·68	83·0	17	27	22	8	52	22	83·7	14·95	83·1	D.	·63608	8·1124	8·1115	+·0009	8·1119		
	„	12	12	11	2·8431	0·35	84·4	+0·6	15·59	81·1	17	26	35	8	52	0	84·7	15·52	81·4	N.	·63614	8·1190	8·1178	+·0012	8·1184		
	„	„	15	20	2·8440	0·41	84·3	„	15·21	81·8	17	26	35	8	51	57	84·9	15·42	81·7	N.	·63602	8·1160	8·1154	+·0006	8·1157		
	„	19	12	13	2·8444	0·38	85·1	—0·1	14·98	81·1	17	27	2	8	52	11	84·9	14·98	81·6	V. G. G.	·63606	8·1139	8·1132	+·0007	8·1135		
	„	„	15	18	2·8457	0·33	83·9	„	14·29	82·0	17	28	7	8	52	40	85·1	14·35	82·0	V. G. G.	·63600	8·1049	8·1046	+·0003	8·1047		
	„	26	12	6	2·8446	0·34	86·0	+0·9	14·92	82·0	17	27	7	8	52	12	84·9	14·81	82·4	N.	·63605	8·1139	8·1133	+·0006	8·1136		
	„	„	15	35	2·8451	0·37	85·5	„	14·57	83·0	17	27	15	8	52	15	86·1	14·51	83·0	N.	·63600	8·1102	8·1098	+·0004	8·1100		
Oct.	3	12	22	2·8424	0·39	84·8	+1·3	15·97	81·1	17	25	40	8	51	32	84·3	15·93	81·5	D.	·63602	8·1249	8·1240	+·0009	8·1244	8·1198	3·7439
	„	„	15	35	2·8446	0·37	85·0	„	15·04	82·7	17	26	12	8	51	52	85·2	15·43	82·1	D.	·63593	8·1161	8·1147	+·0014	8·1154		
	„	10	12	5	2·8431	0·37	89·8	+1·2	15·32	85·8	17	24	10	8	50	42	90·0	15·16	86·2	N.	·63609	8·1277	8·1276	+·0001	8·1276		
	„	„	15	20	2·8448	0·36	86·7	„	14·45	86·8	17	25	20	8	51	22	89·9	14·56	86·9	N.	·63599	8·1160	8·1150	+·0010	8·1155		
	„	17	12	10	2·8437	0·43	90·1	+1·1	14·55	85·3	17	25	50	8	51	30	90·4	13·97	86·1	D.	·63631	8·1197	8·1195	+·0002	8·1196		
	„	„	15	31	2·8449	0·37	88·1	„	13·89	87·0	17	26	12	8	51	40	89·7	13·79	87·0	D.	·63614	8·1137	8·1139	−·0002	8·1138		
	„	24	12	3	2·8430	0·42	86·4	+2·4	15·63	83·4	17	25	25	8	51	15	86·5	15·50	83·8	N.	·63600	8·1236	8·1238	−·0002	8·1237		
	„	„	15	29	2·8445	0·39	84·0	„	14·61	83·9	17	25	42	8	51	25	86·5	14·92	84·0	N.	·63580	8·1161	8·1163	−·0002	8·1162		
	„	31	12	22	2·8426	0·37	86·1	+1·8	15·96	81·7	17	25	20	8	51	18	85·0	15·85	81·9	D.	·63596	8·1262	8·1257	+·0005	8·1259		
	„	„	15	18	2·8447	0·40	84·0	„	14·82	82·1	17	26	00	8	51	35	84·9	15·14	81·8	D.	·63570	8·1160	8·1158	+·0002	8·1159		
Nov.	7	12	4	2·8428	0·42	86·0	+4·9	15·82	82·4	17	25	22	8	51	17	85·3	15·70	82·8	N.	·63596	8·1253	8·1251	+·0002	8·1252	8·1132	3·7408
	„	„	15	24	2·8435	0·37	86·6	„	15·25	84·2	17	25	25	8	51	15	87·5	15·40	83·5	N.	·63606	8·1218	8·1219	−·0001	8·1218		
	„	14	12	21	2·8473	0·42	86·0	+4·8	13·51	82·1	17	29	40	8	53	28	85·8	13·30	82·9	D.	·63627	8·0960	8·0954	+·0006	8·0957		
	„	„	15	36	2·8488	0·46	84·5	„	12·75	83·9	17	30	37	8	53	52	86·3	12·69	83·7	D.	·63612	8·0865	8·0865	·0000	8·0865		
	„	21	12	3	2·8434	0·44	87·5	+4·7	15·78	82·9	17	25	20	8	51	24	86·9	15·59	83·3	N.	·63603	8·1234	8·1223	+·0011	8·1228		
	„	„	15	23	2·8443	0·44	84·5	„	14·86	84·4	17	26	2	8	51	40	86·5	15·14	84·1	N.	·63596	8·1161	8·1156	+·0005	8·1158		
	„	28	11	59	2·8435	0·42	86·1	+5·5	15·69	82·6	17	25	25	8	51	28	86·1	15·54	83·1	D.	·63593	8·1227	8·1214	+·0013	8·1220		
	„	„	15	24	2·8444	0·44	84·0	„	14·88	84·6	17	25	48	8	51	37	86·2	15·05	84·1	D.	·63577	8·1167	8·1156	+·0011	8·1161		
Dec.	5	12	13	2·8425	0·42	85·5	—9·2	16·26	81·6	17	25	10	8	51	14	85·1	16·16	82·0	N.	·63584	8·1255	8·1249	+·0006	8·1252	8·1210	3·7444
	„	„	15	19	2·8429	0·39	84·3	„	15·69	82·7	17	25	25	8	51	21	85·6	15·77	82·4	N.	·63583	8·1219	8·1214	+·0005	8·1216		
	„	12	12	10	2·8429	0·37	81·6	—8·1	16·09	80·2	17	25	45	8	51	34	81·6	15·98	80·6	D.	·63543	8·1221	8·1214	+·0007	8·1217		
	„	„	15	34	2·8438	0·40	80·8	„	15·49	81·0	17	26	27	8	51	57	82·2	15·63	81·1	D.	·63554	8·1158	8·1147	+·0011	8·1152		
	„	19	12	12	2·8435	0·46	86·2	—9·4	16·28	82·1	17	24	40	8	51	7	86·3	15·95	82·6	V. G. G.	·63554	8·1238	8·1223	+·0015	8·1230		
	„	„	15	19	2·8453	0·44	87·2	„	14·93	84·0	17	25	12	8	51	22	87·1	15·32	83·4	V. G. G.	·63568	8·1169	8·1154	+·0015	8·1161		
	„	26	12	6	2·8421	0·46	81·3	—8·4	16·76	77·9	17	25	42	8	51	36	81·6	16·46	79·1	V. G. G.	·63555	8·1242	8·1229	+·0013	8·1235		
	„	„	15	24	2·8425	0·42	81·1	„	15·91	80·8	17	25	49	8	51	39	82·1	16·18	80·1	V. G. G.	·63565	8·1221	8·1208	+·0013	8·1214		

The mean value of the Horizontal Force for the year 1894 = 8·1171 | 3·7426

Absolute Magnetical Observations.—Table II.

Observations of Absolute Declination.

1894.

1894. Date.	Bombay Civil Time.	Mean Readings. Collimator Magnet. Scale apparently Erect.	Collimator Magnet. Scale apparently Inverted.	Horizontal Circle with Telescope pointed to. Scale of Collimator Magnet.	Horizontal Circle with Telescope pointed to. Tárdeo Chimney.	Torsion. Mean.	Torsion. Effect of 90°.	Observer.	Corresponding reading of large Declination Magnetometer.	Absolute Easterly Declination corrected for Torsion.	Monthly Mean. Corresponding reading of large Declination Magnetometer.	Monthly Mean. Absolute Easterly Declination.
1	2	3	4	5	6	7	8	9	10	11	12	13
	h. m.	Sc. div.	Sc. div.	° ′ ″	° ′ ″	°	Sc. div.		Sc. div.	° ′ ″	Sc. div.	° ′ ″
JAN. 4	11 21	+1·50	+1·66	17 7 55	196 52 0	0		V.G.G.	34·79	0 42 10		
„ 11	11 30	+1·59	+1·50	17 5 35	196 52 5	0		D.	34·45	0 40 2	34·67	0 41 24
„ 18	11 29	+1·49	+1·67	17 8 30	196 52 5	0		V.G.G.	34·86	0 42 39		
„ 25	11 33	+1·54	+1·56	17 6 35	196 52 15	0		D.	34·59	0 40 45		
FEB. 1	11 23	+1·52	+1·59	17 7 0	196 52 40	0		V.G.G.	34·59	0 40 42		
„ 8	11 36	+1·52	+1·60	17 5 5	196 51 35	0		G.S.J.	34·48	0 39 50	34·58	0 40 29
„ 15	11 29	+1·52	+1·60	17 6 5	196 51 30	0		V.G.G.	34·65	0 40 55		
„ 22	11 22	+1·42	+1·80	17 5 50	196 51 22	0		G.S.J.	34·60	0 40 28		
MARCH 1	11 19	+1·51	+1·62	17 5 30	196 51 40	0		V.G.G.	34·56	0 40 9		
„ 8	11 24	+1·54	+1·55	17 6 30	196 51 30	0		D.	34·74	0 41 26		
„ 15	11 29	+1·49	+1·75	17 5 15	196 51 30	0		V.G.G.	34·50	0 39 53	34·49	0 39 53
„ 22	11 23	+1·60	+1·64	17 4 27	196 51 45	0		D.	34·35	0 39 5		
„ 29	11 34	+1·51	+1·66	17 4 25	196 51 50	0		V.G.G.	34·32	0 38 51		
APRIL 5	11 31	+1·51	+1·57	17 2 20	196 51 10	10 E	0·64	D.	34·09	0 37 22		
„ 12	11 40	+1·52	+1·74	17 4 50	196 51 45	0		N.	34·36	0 39 16		
„ 19	11 23	+1·49	+1·67	17 3 35	196 51 25	0		D.	34·24	0 38 24	34·22	0 38 17
„ 26	11 27	+1·51	+1·60	17 2 55	196 51 10	0		N.	34·19	0 38 5		
MAY 3	11 32	+1·49	+1·67	17 5 20	196 52 10	10 E	0·65	D.	34·34	0 39 14		
„ 10	11 30	+1·52	+1·61	17 3 30	196 51 40	0		V.G.G.	34·18	0 38 10		
„ 17	11 32	+1·52	+1·64	17 3 45	196 52 15	0		D.	34·12	0 37 48	34·16	0 38 4
„ 24	11 35	+1·49	+1·72	17 3 47	196 52 20	0		V.G.G.	34·08	0 37 38		
„ 31	11 25	+1·51	+1·67	17 2 45	196 51 30	0		D.	34·06	0 37 30		
JUNE 7	11 41	+1·49	+1·69	17 2 0	196 51 20	0		V.G.G.	33·95	0 36 52		
„ 14	11 31	+1·46	+1·71	17 3 10	196 51 40	0		D.	34·05	0 37 39	34·05	0 37 36
„ 21	11 42	+1·49	+1·67	17 3 30	196 52 0	0		V.G.G.	34·06	0 37 44		
„ 28	11 20	+1·51	+1·67	17 4 15	196 52 20	0		D.	34·13	0 38 10		
JULY 5	11 29	+1·52	+1·61	17 1 0	196 52 0	0		V.G.G.	33·70	0 35 20		
„ 12	11 21	+1·46	+1·72	17 2 40	196 51 50	0		D.	33·98	0 36 58		
„ 19	11 31	+1·49	+1·72	17 3 20	196 51 30	0		V.G.G.	34·14	0 38 1	34·00	0 37 13
„ 26	11 35	+1·54	+1·61	17 3 50	196 51 40	0		D.	34·20	0 38 32		
AUG. 2	11 32	+1·50	+1·71	17 2 22	196 51 40	0		N.	33·95	0 36 54		
„ 9	11 25	+1·59	+1·45	17 2 10	196 51 45	10 E	0·62	D.	33·91	0 36 52		
„ 17	11 39	+1·52	+1·66	17 2 25	196 51 35	0		N.	33·94	0 37 6	33·93	0 37 1
„ 24	11 31	+1·54	+1·64	17 3 15	196 51 15	0		D.	34·10	0 38 19		
„ 30	11 41	+1·49	+1·64	17 1 10	196 51 30	0		N.	33·73	0 35 56		
SEPT. 6	11 27	+1·49	+1·69	17 0 5	196 50 55	0		D.	33·63	0 35 22		
„ 13	11 41	+1·50	+1·62	17 3 35	196 51 50	0		N.	34·03	0 38 3		
„ 20	11 24	+1·49	+1·71	17 1 00	196 50 55	0		D.	33·74	0 36 16	33·86	0 37 3
„ 27	11 39	+1·49	+1·66	17 4 30	196 52 15	0		N.	34·06	0 38 30		
OCT. 4	11 26	+1·47	+1·61	17 1 45	196 51 15	0		D.	33·81	0 36 46		
„ 11	11 38	+1·50	+1·61	17 1 55	196 51 20	0		N.	33·82	0 36 54		
„ 18	11 28	+1·48	+1·71	17 3 55	196 51 50	0		D.	34·04	0 38 16	33·94	0 37 39
„ 25	11 39	+1·50	+1·61	17 4 22	196 52 0	0		N.	34·11	0 38 41		
NOV. 1	11 18	+1·59	+1·65	17 5 5	196 52 15	0		D.	34·19	0 39 12		
„ 8	11 35	+1·52	+1·62	17 4 40	196 51 30	0		N.	34·24	0 39 29		
„ 15	11 31	+1·49	+1·66	17 3 55	196 51 50	0		D.	34·07	0 38 20	34·14	0 38 50
„ 22	11 48	+1·50	+1·65	17 3 25	196 52 10	10 W	0·62	N.	33·96	0 37 40		
„ 29	11 29	+1·52	+1·64	17 5 5	196 51 55	0		D.	34·24	0 39 28		
DEC. 6	11 38	+1·52	+1·59	17 4 35	196 52 27	0		N.	34·16	0 38 50		
„ 13	11 25	+1·54	+1·57	17 5 50	196 51 35	0		D.	34·41	0 40 40	34·21	0 39 15
„ 20	11 35	+1·52	+1·64	17 4 27	196 52 2	0		N.	34·14	0 38 43		
„ 27	11 51	+1·50	+1·71	17 4 40	196 52 15	10 W	0·61	D.	34·15	0 38 46		

The Mean Declination for the year 1894 = 0 38 34

Absolute Magnetical Observations.—Table III.

OBSERVATIONS OF INCLINATION, 1894.

Taken with Barrow's Dip Circle, with Microscopes, No. 49 and two 3½-inch Needles, Nos. 1 and 2, by Dover, Charlton.

1894. Date.	Bombay Civil Time (0 to 24 hours). At commencement.	At conclusion.	Observer.	Needle marked.	End of Needle Dipping. A. Face of Circle. East.	A. Face of Circle. West.	B. Face of Circle. East.	B. Face of Circle. West.	Mean Dip.	Monthly Mean for each Needle.	Monthly Mean.
	h. m.	h. m.			° ′	° ′	° ′	° ′	° ′		° ′
JAN. 2	12 8	13 34	D.	1	20 42·5	21 15·0	20 7·1	20 18·1	20 35·7		
„ 5	14 45	16 10	V.G.G.	2	20 38·2	21 9·7	19 58·0	20 32·0	20 34·5	No. 1	
„ 9	12 3	13 31	D.	2	20 39·2	21 10·7	20 4·5	20 34·7	20 37·3	20 35·1	
„ 13	14 14	15 41	D.	1	20 39·4	21 15·2	20 7·4	20 16·2	20 34·5		
„ 16	12 25	13 58	V.G.G.	1	20 46·9	21 10·4	20 5·0	20 15·5	20 34·4		20 35·5
„ 19	14 52	16 17	V.G.G.	2	20 31·0	21 5·0	20 8·7	20 35·5	20 35·0	No. 2	
„ 23	12 16	13 43	D.	2	20 32·2	21 10·6	20 9·7	20 35·4	20 37·0	20 35·9	
„ 26	15 15	16 36	D.	1	20 41·2	21 14·4	20 0·7	20 24·0	20 35·1		
„ 30	12 23	13 55	V.G.G.	1	20 43·2	21 14·9	20 2·6	20 22·6	20 35·7		
FEB. 2	14 50	16 20	V.G.G.	2	20 37·4	21 8·1	20 6·6	20 30·7	20 35·7		
„ 6	12 20	13 38	G.S.J.	2	20 51·2	21 2·9	20 14·0	20 23·6	20 37·9	No. 1	
„ 9	14 54	16 11	G.S.J.	1	20 49·0	21 18·4	20 2·0	20 21·7	20 37·8	20 39·0	
„ 13	12 29	13 52	V.G.G.	1	20 51·6	21 17·1	20 2·1	20 20·4	20 37·8		20 37·7
„ 16	14 45	16 10	V.G.G.	2	20 43·1	21 2·2	20 12·5	20 26.2	20 36·0		
„ 20	12 21	13 44	G.S.J.	2	20 47·5	21 1·4	20 10·5	20 25·7	20 36·3	No. 2	
„ 23	14 42	16 4	G.S.J.	1	20 57·4	21 17·1	20 5·2	20 23·6	20 40·8	20 36·5	
„ 27	12 15	13 38	V.G.G.	1	20 57·6	21 14·5	20 3·7	20 22·7	20 39·6		
MAR. 2	14 50	16 12	V.G.G.	2	20 46·2	21 3·1	20 7·5	20 27·5	20 36·1		
„ 6	12 21	13 43	D.	2	20 42·2	21 4·2	20 5·6	20 35·7	20 36·9	No. 1	
„ 9	14 25	15 51	D.	1	20 54·9	21 18·0	20 2·0	20 25·6	20 40·1	20 39·7	
„ 13	12 20	13 42	V.G.G.	1	20 48·9	21 15·1	20 2·0	20 33·5	20 39·9		20 38·7
„ 16	14 52	16 16	V.G.G.	2	20 43·4	21 7·4	20 5·5	20 32·6	20 37·2		
„ 20	12 8	13 30	D.	2	20 35·6	21 12·2	20 10·9	20 37·6	20 39·1	No. 2	
„ 23	15 55	17 21	D.	1	20 51·5	21 10·1	20 2·2	20 35·0	20 39·7		
„ 27	12 23	13 40	V.G.G.	1	20 46·9	21 12·0	20 2·2	20 36·0	20 39·3	20 37·7	
„ 30	14 45	16 4	V.G.G.	2	20 40·0	21 10·5	20 7·7	20 39·4	20 39·4		
APRIL 3	12 25	14 12	N.	2	20 37·7	21 15·7	20 4·0	20 41·2	20 39·6		
„ 6	14 39	16 7	N.	1	20 58·0	21 17·5	19 57·2	20 34·2	20 41·7	No. 1.	
„ 10	12 23	13 45	N.	1	20 54·2	21 14·7	20 1·4	20 31·0	20 40·3	20 40·4	
„ 13	14 22	15 56	N.	2	20 51·6	21 11·9	20 10·6	20 24·0	20 39·5		20 39·9
„ 17	12 8	13 35	D.	2	20 36·6	21 13·8	20 13·7	20 35·1	20 39·8	No. 2	
„ 20	15 1	16 29	D.	1	20 41·0	21 11·7	20 5·1	20 39·7	20 39·4	20 39·4	
„ 24	12 15	13 36	N.	1	21 6·5	21 11·4	20 7·4	20 16·1	20 40·3		
„ 27	14 32	16 0	N.	2	20 51·1	21 7·7	20 13·6	20 23·0	20 38·8		

1894. Date.	Bombay Civil Time (0 to 24 hours). At commencement.	At conclusion.	Observer.	Needle marked.	End of Needle Dipping. A. Face of Circle. East.	A. Face of Circle. West.	B. Face of Circle. East.	B. Face of Circle. West.	Mean Dip.	Monthly Mean for each Needle.	Monthly Mean.
	h. m.	h. m.			° ′ ″	° ′	° ′	° ′	° ′		
MAY 1	12 7	13 30	D.	2	20 55·7	21 8·0	20 19·5	20 22·7	20 41·5		
„ 4	15 13	16 36	D.	1	21 5·1	21 10·2	20 13·2	20 21·6	20 42·5	No. 1	
„ 8	12 18	13 43	V.G.G.	1	20 58·9	21 10·5	20 12·7	20 16·9	20 39·7	20 40·6	
„ 11	14 46	16 20	V.G.G.	2	20 52·2	21 4·5	20 17·5	20 27·1	20 40·3		
„ 15	12 12	13 34	D.	2	20 49·0	21 11·0	20 19·9	20 19·7	20 39·9		20 40·6
„ 18	15 27	16 56	D.	1	21 1·9	21 16·4	20 10·9	20 13·0	20 40·5		
„ 22	12 23	13 45	V.G.G.	1	20 56·2	21 14·2	20 12·6	20 15·7	20 39·7	No. 2	
„ 25	14 55	16 25	V.G.G.	2	20 55·2	21 6·7	20 16·2	20 23·1	20 40·3	20 40·6	
„ 29	12 13	13 40	D.	2	20 57·0	21 13·7	20 11·5	20 21·6	20 40·9		
JUNE 1	15 12	16 38	D.	1	20 52·9	21 17·7	20 12·5	20 16·6	20 39·9		
„ 5	12 10	13 44	N.	1	21 5·7	21 4·1	20 18·2	20 7·1	20 38·8	No. 1	
„ 8	14 27	15 53	N.	2	21 0·4	21 9·2	20 15·4	20 22·7	20 41·9	20 39·5	
„ 12	12 25	13 51	D.	2	21 7·6	21 11·0	20 17·4	20 22·6	20 44·6		
„ 15	15 7	16 30	D.	1	21 9·2	21 7·1	20 12·9	20 6·7	20 39·0		20 41·0
„ 19	12 25	13 53	V.G.G.	1	21 3·5	21 9·0	20 13·5	20 8·9	20 38·7	No. 2	
„ 22	14 45	16 15	V.G.G.	2	20 52·5	21 8·2	20 17·0	20 28·6	20 41·6		
„ 26	12 3	13 31	D.	2	20 56·0	21 9·0	20 12·4	20 30·7	20 42·0	20 42·5	
„ 29	14 59	16 22	D.	1	21 9·7	21 3·5	20 16·4	20 14·2	20 40·9		
JULY 3	12 25	13 46	V.G.G.	1	21 1·7	21 12·5	20 15·2	20 17·2	20 41·6		
„ 6	14 32	16 2	V.G.G.	2	20 55·2	21 9·5	20 8·7	20 29·5	20 40·7	No. 1	
„ 10	11 58	13 23	D.	2	20 57·9	21 7·2	20 12·1	20 29·5	20 41·7	20 41·9	
„ 13	14 50	16 14	D.	1	21 5·6	21 14·1	20 8·6	20 20·2	20 42·1		
„ 17	12 20	13 45	V.G.G.	1	21 7·5	21 12·0	20 6·2	20 23·0	20 42·2		20 41·9
„ 20	14 45	16 10	V.G.G.	2	20 57·2	21 12·5	20 13·9	20 28·0	20 42·9		
„ 24	12 7	13 30	D.	2	20 57·7	21 8·7	20 14·0	20 30·7	20 42·8	No. 2	
„ 27	14 53	16 30	D.	1	21 5·2	21 14·5	20 6·8	20 23·0	20 42·4	20 42·0	
„ 31	12 15	13 36	N.	1	21 10·2	21 12·4	20 17·9	20 5·1	20 41·4		
AUG. 3	14 30	15 53	N.	2	21 6·1	21 0·4	20 31·1	20 15·5	20 43·3		
„ 7	12 4	13 28	D.	2	20 58·7	21 6·2	20 25·0	20 17·7	20 41·9	No.	
„ 10	15 25	16 46	D.	1	21 7·9	21 6·5	20 19·0	20 10·9	20 41·1	20 39·9	
„ 14	12 20	13 42	N.	1	21 12·0	21 0·4	20 16·9	20 9·6	20 39·7		
„ 17	14 15	15 35	N.	2	21 10·4	20 58·1	20 28·2	20 11·9	20 42·1		20 41·3
„ 21	12 6	13 40	D.	2	21 12·2	20 48·9	20 30·2	20 18·2	20 42·4	No. 2	
„ 24	15 40	17 2	D.	1	21 2·2	21 9·0	20 18·2	20 10·0	20 39·8	20 42·7	
„ 28	12 20	13 43	N.	1	21 11·9	20 58·2	20 19·9	20 5·6	20 38·9		
„ 31	14 28	15 52	N.	2	21 4·5	20 48·7	20 37·9	20 23·5	20 43·6		

1894. Date.	Bombay Civil Time (0 to 24 hours). At commencement.	At conclusion.	Observer.	Needle marked.	End of Needle Dipping. A. Face of Circle. East.	A. Face of Circle. West.	B. Face of Circle. East.	B. Face of Circle. West.	Mean Dip.	Monthly Mean for each Needle.	Monthly Mean.
	h. m.	h. m.			° ′	° ′	° ′	° ′	° ′		° ′
SEPT. 4	12 15	13 39	D.	2	21 7·7	20 44·5	20 37·2	20 24·1	20 43·4		
„ 7	15 18	16 42	D.	1	21 12·7	21 0·6	20 16·5	20 16·1	20 41·5	No. 1	
„ 11	12 10	13 26	N.	1	21 12·1	21 3·7	20 16·4	20 5·0	20 39·3	20 40·4	
„ 14	14 15	15 28	N.	2	21 8·9	20 50·7	20 31·7	20 18·2	20 42·4		20 41·4
„ 18	12 5	13 28	D.	2	21 15·5	20 48·0	20 19·0	20 24·4	20 41·7	No. 2	
„ 21	15 25	16 44	D.	1	21 14·5	21 4·5	20 16·7	20 8·6	20 41·1	20 42·5	
„ 25	12 10	13 25	N.	1	21 14·1	21 1·0	20 18·7	20 5·7	20 39·9		
„ 28	14 39	16 5	N.	2	21 14·8	20 55·0	20 29·2	20 11·2	20 42·4		
OCT. 2	12 51	14 15	D.	2	21 26·5	20 30·5	20 44·5	20 18·0	20 44·9		
„ 5	15 24	16 55	D	1	21 5·1	20 55·7	20 22·4	20 18·7	20 40·5	No. 1	
„ 8	12 22	13 50	N.	1	21 3·9	21 3·7	20 6·6	20 19·5	20 38·4	20 40·0	
„ 12	14 30	15 58	N.	2	21 5·1	21 1·9	20 25·0	20 19·4	20 42·8		
„ 16	12 15	13 42	D.	2	20 58·1	21 11·2	20 25·2	20 22·2	20 44·2		20 41·5
„ 19	14 19	15 41	D.	1	21 9·7	21 1·7	20 10·5	20 16·4	20 39·6	No. 2	
„ 23	13 15	14 35	N.	1	21 12·7	21 5·6	20 16·4	20 11·5	20 41·5	20 43·0	
„ 26	14 28	15 55	N.	2	21 6·0	20 53·2	20 29·2	20 16·9	20 41·3		
„ 30	12 0	13 30	D.	2	21 8·0	20 58·9	20 22·9	20 17·5	20 41·8		
NOV. 2	14 52	16 14	D.	1	21 10·9	21 3·6	20 22·9	20 11·2	20 42·1		
„ 6	12 15	13 45	N.	1	21 14·0	21 3·4	20 18·7	20 15·5	20 42·9	No. 1	
„ 9	14 35	16 6	N.	2	21 12·5	20 57·9	20 23·9	20 17·7	20 43·0	20 44·0	
„ 13	12 5	13 33	D.	2	21 13·5	21 0·2	20 21·7	20 18·6	20 43·5		
„ 16	14 43	16 7	D.	1	21 2·6	21 16·2	20 19·0	20 17·6	20 43·8		20 43·8
„ 20	12 25	13 55	N.	1	20 58·5	21 15·6	20 0·0	20 49·7	20 45·9	No 2	
„ 23	14 30	15 58	N.	2	21 11·2	21 7·5	20 21·0	20 18·0	20 44·4	20 43·7	
„ 27	12 13	13 45	D.	2	21 11·2	21 4·5	20 17·0	20 23·6	20 44·1		
„ 30	14 43	16 9	D.	1	21 8·0	21 15·0	19 52·7	20 45·5	20 45·3		
DEC. 4	12 30	13 53	N.	1	21 12·7	21 10·4	19 59·2	20 43·2	20 46·4		
„ 7	14 26	15 55	N.	2	21 7·2	20 56·5	20 23·6	20 27·2	20 43·6	No. 1	
„ 11	12 16	13 47	D.	2	21 3·7	21 4·2	20 20·4	20 30·5	20 44·7	20 45·5	
„ 18	14 33	16 2	D.	1	21 2·1	21 17·7	20 10·0	20 33·6	20 45·8		
„ 14	12 3	13 37	N.	1	21 2·1	21 20·0	20 14·5	20 24·0	20 45·1		20 44·8
„ 21	14 30	16 0	N.	2	20 57·1	21 3·2	20 22·7	20 30·9	20 43·5	No. 2	
„ 25	11 54	13 21	D.	2	20 58·7	21 7·7	20 19·0	20 34·6	20 45·0	20 44·2	
„ 28	15 7	16 32	D.	1	21 2·5	21 17·2	20 13·7	20 26·4	20 44·9		

The Mean Dip for the year ... { With Needle No. 1 = 20 ° 40·5 / With Needle No. 2 = 20 40·9

The Mean Dip for the year 1894 = 20 ° 40·7

Absolute Magnetical Observations.—Table III *a.*

SUPPLEMENTARY OBSERVATIONS OF INCLINATION, 1894.

Taken with Barrow's Dip Circle, with Microscopes, No. 49 and two 3½-inch Needles, Nos. $\frac{1}{81}$ and $\frac{2}{81}$, by John Dover.

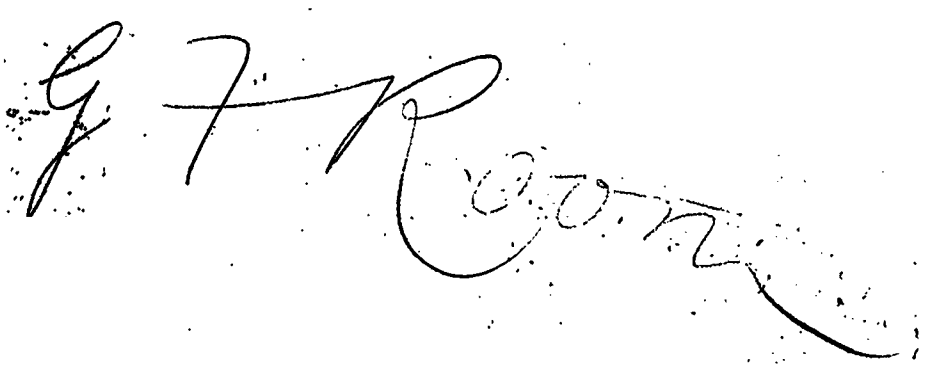
1894. Date.	Bombay Civil Time (0 to 24 hours). At commencement.	At conclusion.	Observer.	Needle marked.	End of Needle Dipping. A. Face of Circle. East.	A. Face of Circle. West.	B. Face of Circle. East.	B. Face of Circle. West.	Mean Dip.	Monthly Mean for each Needle.	Monthly Mean.
	h. m.	h. m.			° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′	° ′	° ′
JAN. 2	11 25	14 28	D.	$\frac{2}{81}$	20 29·9	20 43·5	20 25·2	20 50·7	20 37·3		
„ 5	13 50	17 10	V.G.G.	$\frac{2}{81}$	20 24·5	20 43·4	20 23·1	20 50·5	20 35·4	No. $\frac{1}{81}$	
„ 9	11 10	14 44	D.	$\frac{2}{81}$	20 28·5	20 38·0	20 29·7	20 51·0	20 36·8	20 36·8	
„ 13	13 20	16 34	D.	$\frac{1}{81}$	20 32·2	20 46·0	20 23·0	20 47·0	20 37·0		
„ 16	11 25	14 50	V.G.G.	$\frac{1}{81}$	20 21·4	20 43·6	20 31·5	20 51·0	20 36·9		20 36·0
„ 19	14 0	17 10	V.G.G.	$\frac{2}{81}$	20 21·2	20 40·7	20 27·0	20 47·6	20 34·1	No. $\frac{2}{81}$	
„ 23	11 25	14 40	D.	$\frac{2}{81}$	20 22·2	20 41·2	20 33·7	20 53·1	20 35·0	20 35·3	
„ 26	14 11	17 33	D.	$\frac{1}{81}$	20 28·1	20 39·7	20 25·5	20 49·9	20 35·8		
„ 30	11 25	14 49	V.G.G.	$\frac{1}{81}$	20 30·5	20 35·6	20 28·9	20 53·2	20 37·0		
FEB. 2	13 55	17 12	V.G.G.	$\frac{2}{81}$	20 28·0	20 36·5	20 32·2	20 47·0	20 35·9		
„ 6	11 28	14 33	G.S.J.	$\frac{2}{81}$	20 39·5	20 38·4	20 29·7	20 36·6	20 36·0	No. $\frac{1}{81}$	
„ 9	14 0	17 6	G.S.J.	$\frac{1}{81}$	20 36·0	20 44·6	20 22·6	20 52·2	20 38·8	20 40·1	
„ 13	11 35	14 47	V.G.G.	$\frac{1}{81}$	20 33·0	20 44·4	20 28·7	20 51·7	20 39·4		20 37·9
„ 16	13 50	17 4	V.G.G.	$\frac{2}{81}$	20 33·2	20 36·1	20 31·4	20 41·7	20 35·6		
„ 20	11 25	14 43	G.S.J.	$\frac{2}{81}$	20 48·2	20 33·1	20 31·7	20 30·2	20 35·8	No. $\frac{2}{81}$	
„ 23	13 50	17 3	G.S.J.	$\frac{1}{81}$	20 40·5	20 47·9	20 32·1	20 46·2	20 41·7	20 35·8	
„ 27	11 25	14 30	V.G.G.	$\frac{1}{81}$	20 37·0	20 43·5	20 28·0	20 53·1	20 40·4		
MAR. 2	13 55	17 7	V.G.G.	$\frac{2}{81}$	20 31·0	20 33·6	20 34·9	20 44·9	20 36·1		
„ 6	11 30	14 35	D.	$\frac{2}{81}$	20 34·2	20 34·4	20 35·7	20 38·7	20 35·7	No. $\frac{1}{81}$	
„ 9	13 31	16 43	D.	$\frac{1}{81}$	20 36·4	20 47·0	20 31·5	20 46·9	20 40·4	20 40·1	
„ 13	11 32	14 39	V.G.G.	$\frac{1}{81}$	20 36·4	20 39·9	20 32·7	20 56·4	20 41·3		
„ 16	13 55	17 5	V.G.G.	$\frac{2}{81}$	20 22·2	20 37·2	20 33·5	20 49·4	20 35·6		20 38·0
„ 20	11 15	14 22	D.	$\frac{2}{81}$	20 24·0	20 36·7	20 35·9	20 45·9	20 35·6	No. $\frac{2}{81}$	
„ 23	15 5	18 12	D.	$\frac{1}{81}$	20 35·6	20 41·2	20 25·6	20 56·5	20 39·7		
„ 27	11 30	14 30	V.G.G.	$\frac{1}{81}$	20 29·1	20 44·4	20 30·2	20 52·0	20 38·9	20 35·9	
„ 30	13 55	17 1	V.G.G.	$\frac{2}{81}$	20 26·0	20 37·9	20 35·0	20 46·7	20 36·4		
APRIL 3	11 20	15 14	N.	$\frac{2}{81}$	20 24·2	20 46·6	20 35·4	20 36·9	20 35·8		
„ 6	13 38	17 7	N.	$\frac{1}{81}$	20 23·1	20 44·9	20 42·2	20 51·1	20 40·3	No. $\frac{1}{81}$	
„ 10	11 25	14 38	N.	$\frac{1}{81}$	20 28·4	20 46·7	20 38·5	20 46·4	20 40·0	20 39·9	
„ 13	13 26	16 55	N.	$\frac{2}{81}$	20 32·6	20 47·7	20 27·9	20 34·7	20 35·7		
„ 17	11 15	14 31	D.	$\frac{2}{81}$	20 28·5	20 45·4	20 28·7	20 46·2	20 37·2		20 38·0
„ 20	14 8	17 23	D.	$\frac{1}{81}$	20 26·9	20 43·6	20 33·7	20 53·7	20 39·5	No. $\frac{2}{81}$	
„ 24	11 20	14 33	N.	$\frac{1}{81}$	20 36·1	20 40·0	20 39·0	20 44·5	20 39·9	20 36·2	
„ 27	13 41	16 52	N.	$\frac{2}{81}$	20 34·5	20 32·4	20 49·7	20 27·9	20 36·1		

1894. Date.	Bombay Civil Time (0 to 24 hours). At commencement.	At conclusion.	Observer.	Needle marked.	End of Needle Dipping. A. Face of Circle. East.	A. Face of Circle. West.	B. Face of Circle. East.	B. Face of Circle. West.	Mean Dip.	Monthly Mean for each Needle.	Monthly Mean.
	h. m.	h. m.			° ′	° ′	° ′	° ′	° ′		
MAY 1	11 15	14 25	D.	$\frac{2}{81}$	20 33·6	20 33·0	20 46·9	20 38·2	20 37·9		
„ 4	14 20	17 34	D.	$\frac{1}{81}$	20 30·5	20 40·1	20 45·7	20 49·1	20 41·3	No. $\frac{1}{81}$	
„ 8	11 25	14 40	V.G.G.	$\frac{1}{81}$	20 28·5	20 43·7	20 42·7	20 46·5	20 40·3	20 40·7	
„ 11	13 52	17 7	V.G.G.	$\frac{2}{81}$	20 30·1	20 32·4	20 47·7	20 35·5	20 36·4		
„ 15	11 20	14 28	D.	$\frac{2}{81}$	20 34·5	20 29·7	20 43·3	20 39·4	20 36·7		20 38·9
„ 18	14 35	17 48	D.	$\frac{1}{81}$	20 31·1	20 43·5	20 45·1	20 43·0	20 40·7	No. $\frac{2}{81}$	
„ 22	11 27	14 40	V.G.G.	$\frac{1}{81}$	20 36·5	20 33·5	20 46·5	20 45·5	20 40·5	20 37·2	
„ 25	14 2	17 20	V.G.G.	$\frac{2}{81}$	20 30·4	20 36·9	20 43·6	20 36·5	20 36·8		
„ 29	11 20	14 34	D.	$\frac{2}{81}$	20 28·7	20 35·0	20 49·0	20 40·4	20 38·3		
JUNE 1	14 20	17 32	D.	$\frac{1}{81}$	20 38·7	20 34·7	20 46·4	20 46·4	20 41·5		
„ 5	11 20	14 38	N.	$\frac{1}{81}$	20 39·7	20 44·2	20 38·2	20 38·4	20 40·1	No. $\frac{1}{81}$	
„ 8	13 34	16 49	N.	$\frac{2}{81}$	20 44·5	20 40·7	20 37·6	20 34·1	20 39·2		
„ 12	11 15	14 46	D.	$\frac{2}{81}$	20 45·0	20 38·5	20 41·6	20 34·6	20 39·9	20 40·1	
„ 15	14 8	17 21	D.	$\frac{1}{81}$	20 38·1	20 42·5	20 37·2	20 38·7	20 39·1		20 39·9
„ 19	11 29	14 40	V.G.G.	$\frac{1}{81}$	20 35·1	20 41·0	20 36·0	20 44·2	20 39·1	No. $\frac{2}{81}$	
„ 22	13 53	17 13	V.G.G.	$\frac{2}{81}$	20 37·2	20 43·5	20 39·9	20 36·5	20 39·3		
„ 26	11 10	14 32	D.	$\frac{2}{81}$	20 36·7	20 42·7	20 42·7	20 39·0	20 40·3	20 39·7	
„ 29	14 5	17 14	D.	$\frac{1}{81}$	20 43·9	20 39·4	20 36·1	20 42·5	20 40·5		
JULY 3	11 30	14 39	V.G.G.	$\frac{1}{81}$	20 33·2	20 36·5	20 39·9	20 48·9	20 39·6		
„ 6	13 42	17 0	V.G.G.	$\frac{2}{81}$	20 36·6	20 41·1	20 37·0	20 39·5	20 38·5	No. $\frac{1}{81}$	
„ 10	11 5	14 16	D.	$\frac{2}{81}$	20 33·0	20 41·5	20 38·2	20 44·0	20 39·2		
„ 13	13 58	17 8	D.	$\frac{1}{81}$	20 29·5	20 38·1	20 43·4	20 49·0	20 40·0	20 39·3	
„ 17	11 23	14 40	V.G.G.	$\frac{1}{81}$	20 27·9	20 41·2	20 44·4	20 42·0	20 38·9		20 38·8
„ 20	13 50	17 7	V.G.G.	$\frac{2}{81}$	20 31·2	20 40·0	20 37·0	20 43·0	20 37·8		
„ 24	11 15	14 23	D.	$\frac{2}{81}$	20 31·0	20 40·1	20 37·0	20 45·0	20 38·3	No. $\frac{2}{81}$	
„ 27	14 0	17 12	D.	$\frac{1}{81}$	20 29·2	20 41·0	20 45·7	20 42·5	20 39·6	20 38·4	
„ 31	11 24	14 35	N.	$\frac{1}{81}$	20 47·6	20 30·2	20 44·1	20 31·0	20 38·2		
AUG. 3	13 40	16 45	N.	$\frac{2}{81}$	20 41·1	20 37·6	20 43·4	20 26·7	20 37·2		
„ 7	11 12	14 20	D.	$\frac{2}{81}$	20 37·0	20 41·2	20 43·6	20 28·2	20 37·5		
„ 10	14 35	17 42	D.	$\frac{1}{81}$	20 47·6	20 30·5	20 46·7	20 26·3	20 37·8	No. $\frac{1}{81}$	
„ 14	11 27	14 35	N.	$\frac{1}{81}$	20 39·5	20 46·5	20 33·5	20 37·6	20 39·3	20 39·3	
„ 17	13 25	16 30	N.	$\frac{2}{81}$	20 44·4	20 32·9	20 36·5	20 32·0	20 36·4		20 38·4
„ 21	11 14	14 30	D.	$\frac{2}{81}$	20 49·7	20 35·2	20 41·2	20 27·7	20 38·4		
„ 24	14 49	17 55	D.	$\frac{1}{81}$	20 36·0	20 34·2	20 48·9	20 45·5	20 41·1	No. $\frac{2}{81}$	
„ 28	11 27	14 40	N.	$\frac{1}{81}$	20 39·9	20 35·7	20 51·2	20 30·2	20 39·2		
„ 31	13 35	16 43	N.	$\frac{2}{81}$	20 48·1	20 30·0	20 42·4	20 30·7	20 37·8	20 37·5	

1894. Date.	Bombay Civil Time (0 to 24 hours). At commencement.	At conclusion.	Observer.	Needle marked.	End of Needle Dipping. A. Face of Circle. East.	A. Face of Circle. West.	B. Face of Circle. East.	B. Face of Circle. West.	Mean Dip.	Monthly Mean for each Needle.	Monthly Mean.
	h. m.	h. m.			° ′	° ′	° ′	° ′	° ′	° ′	° ′
SEPT. 4	11 20	14 32	D.	2/81	20 46·0	20 30·6	20 47·4	20 32·5	20 39·1		
„ 7	14 26	17 37	D.	1/81	20 42·9	20 32·4	20 58·7	20 29·6	20 40·9	No. 1/81	
„ 11	11 20	14 26	N.	1/81	20 50·7	20 35·5	20 47·7	20 23·9	20 39·4	20 39·8	
„ 14	13 25	16 25	N.	2/81	20 58·0	20 27·1	20 37·2	20 24·6	20 36·7		20 38·6
„ 18	11 12	14 21	D.	2/81	21 0·6	20 31·4	20 25·6	20 31·0	20 37·1		
„ 21	14 32	17 36	D.	1/81	20 53·2	20 31·0	20 46·5	20 28·0	20 39·7	No. 2/81	
„ 25	11 19	14 25	N.	2/81	20 41·1	20 41·2	20 41·5	20 33·0	20 39·2	20 37·4	
„ 28	13 53	16 56	N.		20 58·9	20 25·9	20 41·1	20 20·5	20 36·6		
OCT. 2	11 36	15 17	D.	2/81	20 58·5	20 22·6	20 35·5	20 48·6	20 41·3		
„ 5	14 29	17 46	D.	1/81	20 53·5	20 41·9	20 42·9	20 35·0	20 43·3	No. 1/81	
„ 8	11 25	14 45	N.	1/81	20 41·9	20 38·2	20 41·1	20 50·0	20 42·8	20 42·8	
„ 12	13 33	17 10	N.	2/81	20 42·7	20 38·9	20 34·0	20 34·7	20 37·6		
„ 16	11 20	14 37	D.	2/81	20 58·1	20 50·1	20 24·1	20 28·5	20 40·2		20 41·1
„ 19	13 26	16 35	D.	1/81	20 47·4	20 38·0	20 31·1	20 49·4	20 41·5	No. 2/81	
„ 23	11 20	15 28	N.	1/81	20 49·7	20 35·2	20 47·0	20 42·7	20 43·6	20 39·4	
„ 26	13 40	16 50	N.	2/81	20 48·1	20 52·1	20 16·0	20 37·6	20 38·4		
„ 30	11 5	14 21	D.	2/81	20 49·2	20 53·5	20 23·6	20 31·4	20 39·4		
NOV. 2	13 58	17 7	D.	1/81	20 51·5	20 32·7	20 55·2	20 35·4	20 43·7		
„ 6	11 19	14 40	N.	1/81	20 48·4	20 35·4	20 50·7	20 45·1	20 44·9	No. 1/81	
„ 9	13 44	17 0	N.	2/81	20 48·2	20 46·6	20 37·5	20 28·5	20 40·2	20 44·2	
„ 13	11 11	14 29	D.	2/81	20 52·4	20 38·7	20 43·7	20 25·0	20 39·9		
„ 16	13 50	17 1	D.	1/81	20 34·5	20 46·5	20 47·1	20 44·6	20 43·2		20 42·1
„ 20	11 30	14 50	N.	1/81	20 40·2	20 52·5	20 42·6	20 45·5	20 45·2		
„ 23	13 35	16 50	N.	2/81	20 46·9	20 42·0	20 22·2	20 47·7	20 39·7	No. 2/81	
„ 27	11 20	14 47	D.	2/81	20 41·0	20 41·9	20 25·7	20 53·7	20 40·6	20 40·1	
„ 30	13 50	17 2	D.	1/81	20 32·3	20 46·9	20 46·0	20 50·0	20 43·8		
DEC. 4	11 27	14 50	N.	1/81	20 32·0	20 47·7	20 44·1	20 57·9	20 45·4		
„ 7	13 31	16 50	N.	2/81	20 35·7	20 44·2	20 27·4	20 58·1	20 41·3	No. 1/81	
„ 11	11 17	14 41	D.	2/81	20 40·1	20 42·5	20 30·9	20 56·2	20 42·4	20 44·0	
„ 14	13 38	16 58	D.	1/81	20 38·7	20 55·5	20 35·6	20 48·0	20 44·4		20 42·8
„ 18	11 10	14 37	N.	1/81	20 39·0	21 2·9	20 32·0	20 41·1	20 43·7	No. 2/81	
„ 21	13 35	16 55	N.	2/81	20 40·9	20 48·4	20 25·5	20 49·1	20 41·0	20 41·6	
„ 25	10 58	14 17	D.	2/81	20 39·4	20 48·5	20 29·2	20 50·7	20 41·9		
„ 28	14 15	17 25	D.	1/81	20 41·0	20 59·9	20 34·0	20 35·7	20 42·6		

The Mean Dip for the year... { With Needle No. 1/81 = 20 40·5 ; With Needle No. 2/81 = 20 37·8 }

The Mean Dip for the year 1894 = 20 39·2



MAGNETICAL AND METEOROLOGICAL OBSERVATIONS

MADE AT THE

GOVERNMENT OBSERVATORY, BOMBAY,

1895.

LIBRARY OF THE BOMBAY BRANCH OF THE ROYAL ASIATIC SOCIETY

WITH AN APPENDIX.

MAGNETICAL AND METEOROLOGICAL OBSERVATIONS

AT THE

GOVERNMENT OBSERVATORY, BOMBAY,

1895,

MADE, REDUCED AND TABULATED UNDER THE DIRECTION OF

CHARLES CHAMBERS, Esq., F.R.S.,

AND

N. A. F. MOOS, Esq., B.Sc.(Edin.), F.R.S.E., &c.

WITH AN APPENDIX

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1896.

TABLE OF CONTENTS.

	Page.
INTRODUCTION TO THE METEOROLOGICAL AND MAGNETICAL OBSERVATIONS, 1895.	
Thirty-fourth number of series	i.
Local situation and geographical position, &c., of the Observatory	id.
Directorship of the Observatory	id.
Personal Establishment and Arrangements, 1895	ii.
Distribution of duties	id.
System of Observation	iii.
Daily routine operations	id.
Weekly routine operations	iv.
Monthly observations	id.
Quarterly, half-yearly and yearly observations...	id.
General description of the Magnetical and Meteorological Instruments, their adjustments and the process of reduction	id.
(*a*) Meteorological Instruments.	
Standard Barometer, description of...	v.
Error in setting the zero position of the scale, and change of method of observation	id
Corrections for error of verniers	vi.
Corrections applied to the observed readings	id.
Comparison with the Kew Standard Barometer	id.
Barograph	vii.
Dry and Wet-bulb Thermometers...	id.
Standard Dry-bulb	id.
Standard Wet-bulb	id.
Photographic Dry-bulb and Wet-bulb	id.
Ground Thermometers...	id.
Robinson-Beckley Anemograph, description of...	viii.
Tabulation of anemograms	ix.
Method of reduction	id.
Rain Gauges	x.
Newman's Rain Gauge	id.
Photographic Rain Gauge	id.
New syphon of modified form	xi.
Constants for converting syphon discharges into inches of rainfall ...	id.
Measurement and distribution of syphon discharges	id.
Determination of scale of rainfall ordinates	id.
(*b*) Magnetical Instruments, 1895	xii.
Kew pattern Unifilar Magnetometer	id.
Kew Dip Circle	id.
Processes of Reduction and Description of the Tables of Meteorological Results, 1895.	
Pressure of Vapour and additional capacity of the Air	xiii.
Table I.—Regnault's values of the pressure of vapour at different temperatures ...	id.
Barometric pressure	id.
Temperature of the Air, &c.	xiv.
Monthly and annual Range of Variation of Meteorological Elements	id.
Notes on Instrumental Changes and on all Irregularities or Departures from the routine of Observation or Reduction, 1895	id.
Robinson-Beckley's Anemograph	id.
Barograph	xv.
Thermograph Dry-bulb...	id.
Thermograph Wet-bulb	id.
Self-registering Rain Gauge	id.

Tables of Results derived from the Continuous Registrations of Automatic Meteorological Instruments and from Meteorological Observations, 1895.

	1895. Table.	Page.
Daily Means of: Barometric Pressure	I	2
Daily Means of: Temperature of the Air	II	3
Daily Means of: Pressure of Vapour	III	4
Daily Means of: Additional Capacity of the Air	IV	5
Individual observations in each Month of the Year, which showed the greatest and the least values of the following elements, *viz.*, Height of Barometer, corrected for Temperature; Temperature of Air; Pressure of Vapour; and Additional Capacity of Air	V	6
Daily. Total Fall of Rain (in inches) as measured by F. Chambers's Self-registering Gauge, the funnel of which is 28 feet above the ground	VI	7
Mean Velocities of the North or South and East or West Components of the Winds which blew on each Day of the Year	VII	8
Mean Velocity of the Wind, in miles per hour, without regard to the direction from which it blew for each day of Bombay Civil Time; also the Mean Monthly Velocity, and its Variation from the Mean of the Year	VIII	9
Sums of the Velocities, and the Mean Velocities, in miles per hour, of the Winds which blew in each Month, from each of the sixteen Principal Directions; and also the number of observations which those sums comprise; the latter numbers indicating the Relative Frequency of the same Wind (as to direction) in the several months, and of different Winds during the same month	IX	10

Tables of Results derived from the Meteorological Observations made daily at 6, 10, 14, 16 and 22 hours, 1895.

	1895. Table.	Page.
Monthly Mean Temperature of the Ground, and its Annual Variation, at the respective depths of 1, 9, 20, 60 and 132 inches below the surface	X	12
Extent of Cloudy Sky—mean of estimations made at 6, 10, 14, 16 and 22 hours daily, the whole sky being reckoned as 10	XI	13
Daily. Total Fall of Rain (in inches) as measured by Newman's Gauge, placed 4½ feet above the ground	XII	14
Five-Day Means, 1895	XIII	15

Tables of Results of Absolute Magnetical Observations, 1895.

	1895. Table.	Page.
Observations of Vibration and Deflection, taken with the Kew Unifilar Magnetometer (No. 23, by Elliot Brothers), for the determination of Absolute Horizontal Force	I	(3)
Observations of Absolute Declination	II	(6)
Observations of Inclination, taken with Barrow's Dip Circle, with Microscopes, No. 49 and two 3¼-inch Needles	III	(7)
Supplementary Observations of Inclination, taken with Barrow's Dip Circle, with Microscopes, No. 49 and two 3½-inch Needles	III *a*	(10)

Fifty years of Meteorological and Magnetical Observations.

	Table.	Page.
Barometric Pressure, 1846–1895	1	[4]
Temperature of the Air, 1846—1895	2	[5]
Pressure of Vapour, 1846—1895	3	[6]
Wind, 1846—1895	4	[7]
Rainfall, 1846—1895	5	[8]
Absolute Magnetical Observations, 1846—1895	6	[9]

INTRODUCTION

TO THE

METEOROLOGICAL AND MAGNETICAL OBSERVATIONS,

1895.

The present volume—the thirty-fourth of its kind—extends the record of Magnetical and Meteorological Observations at the Government Observatory, Bombay, to a full period of fifty years. Although the Observatory was established in 1843, it was not till the year 1846 that the system of observation appears to have been placed upon a correct scientific basis. The institution thus completes an existence of half a century, during which an uninterrupted record of systematic and reliable magnetic and meteorological observations has been kept. For the purpose of ready reference for examination and discussion it has been thought expedient to condense all the valuable data, which lie scattered over the 34 volumes that have from time to time emanated from this Observatory, in the form of an Appendix issued with this volume.

(2) *Local Situation of the Observatory, &c.*—The Observatory is located at the extreme end of a narrow and somewhat rising strip of land called Colába, running about 2 miles south-west from the Fort of Bombay, and separating the Harbour from Back Bay. The mean level of the Observatory compound is 32 feet above the mean level of the sea at Colába. Basaltic traps with their intertrappean beds, which constitute more or less the basis of formation of the whole surrounding coast, crop up at various places through the red sandy soil characteristic of the hills in the vicinity. The nearest elevated ground is Malabár Hill lying northwards at a distance of about 4 miles on the opposite side of the Bay, while that which subtends the largest vertical angle (but less than 1° 7′) as seen from this Observatory, is the southern hill of the island of Karanja situated east-south-east at a distance of about 8 miles across the Harbour. Since the average gradient from Bombay to the Western Ghâts is a little more than 1 in 100, the peculiar situation of the Observatory must influence but little the winds that reach Bombay from over the sea, which is the prevalent direction, and those blowing from landward from the Ghâts and beyond.

The exact geographical position of the Observatory is

Latitude 18° 53′ 45″ North.
Longitude 72° 48′ 56″ East.

The buildings concerned with the production of the observations recorded herein are, (1) the Astronomical Observatory and the Anemometer Tower, with a western wing, the greater part of which serves as a computing room, whilst the remainder is partitioned off for a photographic operating room; (2) the Magnetical Observatory with the adjoining Electrometer Tower; (3) the underground Magnetograph Room; and (4) the Thermograph Shed, enclosing the thermograph room; to which may be added the old thermometer shed.

(3) *Directorship of the Observatory.*—Mr. Charles Chambers, F.R.S., who was so long and so honourably connected with this Observatory, died suddenly

on the 26th February 1896 and the observations of the year 1895, which were taken under his direction, were reduced and tabulated under the direction of Mr. N. A. F. Moos, B.Sc. (Edin.), F.R.S.E., &c. The Observatory owes its present prestige and reputation entirely to the devotion of the late Director. It would be out of place here to enter into the details of the important and very valuable contributions to the science of terrestrial magnetism and meteorology—especially the former—which have from time to time emanated from this Observatory, but the present Director feels it his duty to put on record the fact that not the least of the late Mr. Chambers' services to the cause of science was to enable his successor in office to continue the Observatory under more efficient conditions than he himself found it under, in 1865, and with a fame greatly enhanced by the devotion of a man of Mr. Chambers' reputation and attainments.

(4) Personal establishment and arrangement, 1895—

MAGNETICAL AND METEOROLOGICAL DEPARTMENTS.

The establishment of Assistants in the Magnetical and Meteorological Departments of the Observatory consisted of the following persons :—

First Assistant	... Vinayak Narayan Nene—Fellow of the Bombay University.
Second Assistant	... Ganesh Sadashiv Joshi—Matriculated.
First Observer	... Shitaram Vithal Benderkar.
Second Observer	... Vithal Govind Ganekar—P. S. Certificate.
Third Observer	... Narayan Sakharam Kelkar—P. S. Certificate.
Computer	... Laxuman Balwant Chaphekar—School Final Examination.

ASTRONOMICAL DEPARTMENT.

First Assistant	... Parsharam Laxuman Datar.
Second Assistant	... Damodar Vaman Sathaye. Matriculated.

Vacancies caused by absence on leave of permanent employes were filled on different occasions by Bhalchundra Krishna Fagre.

(5) The duties of the establishment are distributed in the following manner :—

The First Assistants are charged with the determination of values of instrumental constants and the more delicate observations requiring skill and long experience, and they generally control and superintend the whole of the work of their respective departments.

Upon the Second Assistant, Magnetical Department, devolves mostly the photographic operations. He is also responsible for all the photographic instruments which require constant and vigilant attention. The anemograph and meteorological work generally are attended to by the Second Assistant, Astronomical Department. The routine magnetical and meteorological observations are in general made by the observers, including the computer, who are made to take up the work by rotation. Amongst the duties of the observers are included the tabulation of all photograms, calculation and reduction of meteorological and magnetical elements, preparation of various meteorological and other returns, the calculation of daily averages and the writing out of the monthly abstracts. These latter consist of tables having the days of the month marked in numerical order in the first column and the hours of the day in order at the head of the columns, and there is one for each magnetical or meteorological element observed. In no case are the tabulations and reductions allowed to run into arrears unless very urgent special work is on hand. All observers attend the computing office

when not actually engaged on observing duty. The Second Assistant, Astronomical Department, and Third Observer Narayan Sakharam Kelkar are entrusted with the absolute magnetic observations. Although every man is delegated with duties which he is most competent to perform, precautions are taken to keep some of the observers fully instructed in the different operations to provide for the occasional absence of any member of the establishment. All computing operations are systematically performed by one computer and checked by a repetition of the operation by another. Residing accommodation is provided for all the members of the establishment on the Observatory premises. On Sundays and general holidays all observers are set free except 3, one being kept on observing duty, one in charge of photographic instruments and one in charge of astronomical duties. The following are the initials of the members of the staff, which the respective observers attach to the several observations made by them:—

Name.	Initial.
Vinayak Narayan Nene	V. N.
Ganesh Sadashiv Joshi	G. S. J.
Shitaram Vithal Bendarkar	S.
Vithal Govind Ghanekar	V. G. G.
Narayan Sakharam Kelkar	N.
Luxuman Balwant Chaphekar	L.
Parsharam Luxuman Datar...	P.
Damodar Vaman Sathaye	D.
Bhalchundra Krishna Fagre	B. C.

(6) System of Observation.

(*a*) *Daily routine operations.*

Magnetical and meteorological observations are taken every day including Sundays at the hours 6, 10, 14, 16 and 22: the day commencing at midnight, Bombay (Colába), is reckoned from 0 to 24. The time of observation of each element is fixed and the observations are registered with strict punctuality as follows:—

From 5^m to the hour to 2^m after the hour.	Extent and description of clouds, state of the weather, occasional phenomena, and direction of the wind.
At 2^m after the hour.	Thermograph standard thermometer, dry bulb.
	Do. do. wet bulb.
„ 3 „ „ „	Newman's rain gauge (in wet season).
From 5 to 7 „ „ „	Thermometer in ground 1 inch deep.
	Do. do. 9 inches deep.
„ 7 to 9 „ „ „	Newman's standard barometer No. 58 and attached thermometer.
	Do. do. No. 48 and do.
At 12 „ „ „	Grubb's declination magnetometer.
„ 14 „ „ „	Grubb's horizontal force magnetometer and its thermometer.
„ 16 „ „ „	Vertical force magnetograph No. 2 and its thermometer.
„ 17 „ „ „	Vertical force magnetograph No. 1 and its thermometer.
„ 18 „ „ „	Declination magnetograph.
„ 19 „ „ „	Horizontal force magnetograph and its thermometer.
„ 20 „ „ „	Thermometer attached to barograph.

The maximum and minimum thermometers in the thermometer shed, as also the solar radiation thermometer, are read twice daily at 8 and 16 hours.

Observations made once daily include readings of (1) the vacuum gauges of the magnetographs, (2) the maximum and minimum thermometers in magnetograph room, (3) the ground thermometers 20, 60 and 132 inches deep, and (4) nocturnal radiation thermometer. (1) and (2) are read at 10 hours—the maximum and minimum thermometers being reset immediately thereafter, (3) the ground thermometers are read at 14 hours, and (4) the nocturnal radiation thermometer read at 8 hours. Newman's rain gauge is read daily at midnight during the monsoon months, as are also the discharges of the syphon of the self-registering pluviograph once or oftener as required. The electric clock is duly regulated by comparison thrice daily with the sidereal clock. Government chronometers belonging to the Royal Indian Marine and Royal Navy in store at the Observatory and those received from merchant ships in harbour are wound daily or as required, and comparisons with a correct clock are made with sufficient frequency to render the instrument always ready for issue at call with well-determined rates.

(b) Weekly routine Observations.

Double sets of observations of vibration and deflection are made with the unifilar magnetometer every Wednesday for the determination of absolute horizontal force. The same instrument is used every Thursday for the determination of the declination. Observation for magnetic dip are made four times in a week—double sets on every Tuesday and Friday. Transit observations of stars for the determination of time and the errors and rate of the sidereal clock are made on Mondays, Wednesdays and Fridays in the dry months of the year. During the monsoon months no opportunity is lost for observing either the sun or the stars whenever visible.

(c) Monthly Observations.

Regular deflection observations for the two vertical force magnetographs are made with deflector on North side only at 2·5 feet position about the middle of every month between 18_h and 24^h; the deflector used being tested on the Electrometer Tower the day following the former observations.

The magnets of Grubb's declination and Grubb's horizontal force magnetometers are vibrated through a large arc (but less than 1°) about the 20th of every month, and the variation of its accuracy of return to the original position is carefully recorded.

(d) Quarterly, Half-yearly and Yearly Observations.

Once every quarter the weekly intensity observations are supplemented by observation of the magnet with its inertia cylinder.

Once every six months the usual monthly deflection observations of vertical force magnetographs Nos. 1 and 2 are elaborated with deflector on both North and South sides.

Once every year the same series of observations are repeated for the vertical force and horizontal force magnetographs with deflector at various distances on each side of the magnet.

(7) GENERAL DESCRIPTION OF THE MAGNETICAL AND METEOROLOGICAL INSTRUMENTS, THEIR ADJUSTMENTS AND THE PROCESS OF REDUCTION.

The following details show the special circumstances in connection with the condition, situation and adjustments of the various instruments, as also the habits of the observers and their routine processes of reduction, to enable the reader to form an independent judgment as to the reliableness of the observations and the degree of precision attained in the results.

(*a*) Meteorological Instruments.

Standard Barometer.—The barometer mounted on the eastern wall of the magnetical observatory a few feet from the north-east corner of the room is Newman No. 58 and is the same which has been in uninterrupted use since the establishment of the Observatory. Its tube is 0·53 inch in diameter. The cistern, which is of glass, is 37 feet above the mean sea level at Colába. The brass scale is moveable and terminates at the lower end in a point of ivory which for every observation is set so as just to meet its reflected image as seen in the mercury. The scale is primarily divided to 0·05 inch and by means of vernier, 0·002 inch can be read off. To the moving vernier are attached two small brass plates with two lower edges before and behind the tube. The setting of the instrument consists in raising or lowering the vernier until the edges of the brass plates appear just to cut tangentially the convex surface of the mercury in the barometer tube, the line of sight being so regulated in height as to coincide with the edges. A thermometer with a cylindrical bulb dips into the cistern and was in use up to 1884, but in an investigation described in "Bombay Magnetical and Meteorological Observations, 1871 to 1878" it was discovered that the readings of the thermometer, as measuring the temperature of mercurial column, were considerably erroneous and the use of the thermometer was discontinued, and from the beginning of 1885 a thermometer by Murray and Heath, No. 2, divided to half degrees with its bulb immersed in a column of mercury held in a glass tube of nearly the same diameter as that of the barometer tube, was fixed to one side of the barometer, and readings of this thermometer have been used since 1885·0. The error of the attached thermometer varies by about a quarter of a degree within the annual range of the temperature of the barometer, and in adopting a mean error throughout, small pressure corrections of ± ·0003 have been disregarded.

The barometer was lifted down in 1866 and the mercury carefully run up to the top of the tube when it gave the sharp metallic click that is indicative of a good vacuum. It was replaced carefully in its position, the tube, &c., being kept in proper adjustment to verticality. The barometer is of the particular class, a description of which occurs at page 56 of the "Report of the Committee of Physics of the Royal Society 1840" and therefore the scale of the barometer is laid off from the zero point from an authentic standard.

Since 1841, the year it was first mounted, there has been a gradual accumulation of scum on the surface of the mercury in the cistern, and the glass cistern became more and more opaque until the setting operation of the ivory zero point of the scale became a matter of difficulty and some uncertainty. For this reason the usual method adopted as described was changed on the 22nd May 1866. On that day the zero ivory point of the scale was set *once for all* and the setting screw removed, and suitable corrections for capacity were thenceforward applied to the readings. These were taken from the following formula:—

$$\text{Capacity correction} = \cdot 04321\ (h_0 - 29\cdot 943)$$

h_0 represents the uncorrected reading

data for the construction of which will be found in "Bombay Magnetical and Meteorological Observations, 1865—70."

As the fluctuation of the barometer reading from its mean value very rarely reaches ·4 inch, requiring a correction of ·017 inch, it seems very improbable that an error of so much as ·001 inch even occurs from any inaccuracy in the adopted values of the relative capacities of the tube and the cistern. Since the change was effected, the comparability of the observations for showing variations is on that account throughout much better secured.

The depression of mercury due to capillary action in a tube of ·53 inch diameter being small, no correction is applied on this account.

On 30th July 1875 it was discovered that the vernier scale of the barometer was short by ·002 inch. To correct the errors arising from this fault, instructions were issued to note the positions of coincidences at ·000 and ·050 of the vernier scale with the scale of the barometer and also the non-coincidences at the above scales when the barometer reading was in exact half-tenths of an inch. It became then an easy matter to construct a table of corrections and to apply them for all positions of the vernier. These corrections have throughout been applied since then.

The barometer is read daily including Sundays at 7^m after the hours of observation—6, 10, 14, 16 and 22. Each reading is corrected by the application of the temperature correction—reducing the temperature of mercury column to 32° F. and that of the brass scale to 62° F. Another correction is applied to remove the error of discontinuity due to change of thermometer. The first correction is made by means of Table II of the Report of Committee of Physics of the Royal Society, the last by a constant reduction of the corrected pressure by ·002 inch. The considerations on which the last correction is based, are as follow:—(1) the tabulations of the barograph are known to exhibit correctly the diurnal variations of barometric pressure, free from any sensible influence of variations of the temperature of that instrument;* (2) the mean of twenty-four hourly barograph tabulations on any day is taken to correspond to the mean of the same twenty-four hourly pressures observed with Newman's barometer No. 58 and corrected for the temperatures indicated by the old attached thermometer; (3) it does not follow that the mean of the tabulations for the five observation hours (6, 10, 14, 16 and 22) will then correspond exactly to the mean of the observed pressures for the same hours, because the old thermometer does not indicate precisely the actual variations of temperature of the mercurial column: in fact the latter mean pressure was, on the average of all the observation days of the year 1872, ·0008 inch in excess of the former mean pressure; (4) nevertheless the correspondence for the five observation hours was adopted as near enough to identity with the correspondence for the twenty-four hours, and the recorded mean pressures of the years 1873 to 1884 will thus be ·0008 inch in excess of those of the years before 1873; (5) the old attached thermometer and the thermometer No. 2 by Murray and Heath were read together at the five observation hours throughout the year 1883, and the average excess of the former reading over the latter was found to be 0°·62; (6) hence to make the pressures reduced for the readings of Murray and Heath No. 2 correspond to those reduced for the readings of the old thermometer the former pressures must be decreased by ·0027 × 0·62 = ·0017, or—as the pressures are read and calculated only to thousandths of an inch—by ·002 inch. Thus taking the period before 1873·0 as a standard period, the recorded annual mean pressures of the years 1873 to 1884 will be ·0008 inch too high, and those of 1885 and later years ·0005 inch [= —·0020 + ·0017 + ·0008] too high.

Indirect comparisons of the barometer have been made with the Kew standard by means of two mountain barometers by Negretti and Zambra, numbered 705 and 711, when they were both found (in July 1876) to read ·011 inch higher than the Observatory standard. In England, however, they had been found to read ·007 and ·006 respectively higher than the Kew standard. Hence on an average the Observatory standard barometer read ·004 below the Kew standard. It happens that this is exactly the average amount by which the readings of Newman's barometer have been over reduced for temperature (*vide* Introduction to Bombay Magnetical and Meteorological Observations, 1871-78, paragraph 72).

* The data for the construction of this formula will be found in the "Bombay Magnetical and Meteorological Observations, 1865—70," Introduction, pp. x, xi.

Barograph.—The photographic barometer stands separate on two pillars in the magnetograph room. It was supplied through the Kew Committee of the British Association after being tested at the Kew Observatory, and is similar in construction to those adopted by the Meteorological Committee of the Royal Society for the seven observatories established by them in the United Kingdom in the year 1867. A detailed account of the instrument and its particulars and adjustment is given in the "Bombay Magnetical and Meteorological Observations, 1871 to 1878, page xvi to xlvi."

Dry and Wet Bulb Thermometers.

Standard Dry Bulb.—The thermometer is by Casella and marked No. 401: it is a mercurial thermometer, with a cylindrical bulb 3·7 inches long and about 0·37 inch in diameter. The stem is graduated and divided in degrees: the range is from 0° to 120°, measuring 12·36 inches; and the bulb is freely exposed to the air. It is placed in the cage of the thermograph shed about 5 inches from and similarly exposed as the thermometer which records photographically.

Standard Wet Bulb.—This is also a mercurial thermometer by Casella No. 402 and has a cylindrcial bulb 3·7 inches long and 0·37 inch in diameter. The thermometer is graduated on its stem and is divided to degrees with a range from − 10° to +120°, measuring 13·03 inches. The bulb is covered with muslin, and is kept moist by capillary action of a bundle of fine cotton threads immersed in a small vessel of water near the thermometer bulb, and passing loosely round the thermometer stem just over the bulb. The same vessel of water supplies the evaporating fluid to the photographic wet bulb placed about 3 inches distant.

The errors of the above standard thermometers have been carefully found and corrections duly applied. The errors were determined by a Kew standard (No. 368) thermometer in February and March 1875, at fourteen points ranging between 32° and 102°, and the readings were found to be within 0°·1 of the truth. On 20th December 1877, the errors of the freezing points were also tested, showing no noticeable change (*vide* paragraph 53, Table 10 of the Introduction to the Bombay Magnetical and Meteorological Observations, 1871 to 1878).

Photographic Dry Bulb and Wet Bulb.—The height of the bulbs of the thermometers of the thermograph above the ground is 10 feet. The cage is placed on one of the most exposed parts of the Observatory grounds and away from any building; it is, however, screened, as well as the thermograph room in which the recording apparatus is placed, by a roomy shed with a planked roof that is everywhere 2 feet above the roofs of the cage and room: the sides of the shed are of the louvre construction on an enlarged scale, with double sheets of zinc enclosing a thick layer of felt substituted for the wooden laths, and with a vertical distance from lath to lath of one foot: the lowermost two feet of the sides are guarded simply by horizontal iron rods: the roof of the shed is covered with thick felt and then with strong canvas, and the whole of the exterior—sides and roof—is painted or limewashed white.

Ground Thermometers.

Thermometers with their bulbs at the respective depths below the surface of the ground of 1, 9, 20, 60 and 132 inches are regularly observed, the two former five times a day and the three latter once a day at 14 hours. They are all by Newman, of London, and are divided on brass scales, and the value of one division, approximate range of part of scale exposed above ground, and lengths of that part and of one average degree are shown below for each thermometer:—

Depth of Bulb.	Divided to	Approximate Range of exposed part of Scale.	Length of that Range.	Average length of 1°.
Inch.			Inches.	Inch.
1	1°	30° to 145°	8·19	·071
9	0°·2	70° to 115°	5·20	·116
20	1°	35° to 160°	6·73	·054
60	1°	35° to 160°	6·81	·054
132	1°	50° to 140°	6·44	·072

The 1-inch and 9-inch thermometers are on flat brass scale frames, which lie against wooden posts in the ground, and they have their bulbs in contact with the loose red earth which fills the holes in which they are placed; the 20-inch, 60-inch, and 132-inch thermometers have their lower parts enclosed in brass tubes with ends curving off to a point, and the upper parts are in wooden box frames, to which the brass scales are fixed. The reason why only one observation is made daily of the three deeper thermometers is, that it had been found by hourly observations in 1849, 1850 and 1851, that no appreciable diurnal variation of temperature reached the depth of 20 inches.

The errors of graduation of the ground thermometers are unknown.

Robinson-Beckley Anemograph.—From the establishment of the Observatory till December 1865 a rough pressure anemometer was in use. This was replaced by a small anemometer by Robinson which remained in use up to June 1867. From the beginning of the month of June 1867 was brought into use an anemograph of the kind designed by Robinson, with improvements by Robert Beckley, and it remains in action to this day. It was made by Mr. R. W. Munro, and was supplied through the Kew Committee of the British Association, after being tested at the Kew Observatory. In this instrument the arrangements for the registration both of movement and direction of the wind are mounted on one shaft, and the registrations are made on a single sheet of paper, which is changed daily. The essential part of the apparatus for measuring the movement is a vertical spindle, to which cross arms are attached at the top, carrying four hemispherical cups of copper. The cups are attached to their several arms, so that, looking from the central axis, their convex sides are seen turned to the right hand, and the wind, acting with greater effect upon the concave than on the convex sides of the cups, causes the system to rotate in a right-handed direction. It is the number of these rotations, 140 of which are reckoned to a mile of movement of the wind, that tells us how fast the wind has been blowing; and the number is reduced, by means of wheelwork, 7,000 times before reaching a small cylinder, carrying a brass spiral pencil that traces the movement on the registering paper; this latter is metallic paper of the kind used for pocket-books, and is wrapped round a brass cylinder, which is kept rotating by clockwork, and as the paper passes under the spiral pencil, which presses slightly upon it, the black movement trace is received upon it. The wind vane, which consists of a pair of windmill vanes with connecting spindle having an endless screw in the middle, and gearing into a fixed horizontal toothed wheel, is attached to a tube that surrounds the lower part of the vertical movement spindle; to the bottom of the tube is fixed a toothed wheel, which, in communication with other such wheels, conveys the motion of the vane *unchanged* to a small cylinder with spiral pencil, which traces the changes of direction on the register; and it is so arranged that the movement and direction are traced on parallel strips or bands of the same sheet of paper which is changed daily at 10 hours. The heavy parts of the instrument—the direction vane and appendages, and two long brass tubes which connect the instrument proper with the recording apparatus—are supported on friction balls which run in grooves partially filled with oil, thus reducing the friction to a minimum. The instrument is erected on the old

Time Ball Tower, at a height of 53 feet above the ground, and 95 feet above the mean sea level, over a platform 12 feet in diameter, which is designed to give ready access to the instrument, and to protect it from irregular currents of wind, glancing from the convex surface of the dome; and it is supported outside by a fixed cast-iron standard, to which is attached, at the top, the toothed wheel, into which the endless screw of the spindle connecting the windmill vanes gears. The centres of each pair of opposite hemispherical cups are four feet apart, and three and a half feet above the platform, and the diameter of the cups is nine inches. The diameter of the vanes is 15 inches, and the breadth of the fans four inches. The register form is printed in red, with lines dividing its length into hour spaces; and its breadth, on the movement side, into five spaces, each representing 10 miles of movement of the wind, and numbered from 0 to 50 miles; and on the direction side into spaces corresponding to 11¼ degrees on each side of the 16 principal directions N.N.E., N.E., &c.....N.N.W., N., which spaces are numbered consecutively 1, 2, &c..... .15, 16.*

Tabulation of Anemograms.—Numerical tabulations have been made of the movement and direction of the wind during the interval between every two successive hours in the following manner:—the number of miles indicated at the point where the velocity trace cuts a horizontal hour-line being read for two successive hours, the excess of the latter over the former reading (adding 50 if the trace has passed over from left to right of the form) gives the movement for the interval; and the number of the space in which the direction trace lies during the interval is entered as representing the direction. The estimations of movement are made only to the nearest full mile. Should the direction trace not lie all in one space during the whole interval of an hour, then if the change of direction exceed 90° or eight points, the whole observation for that hourly interval is rejected; but if it lie within that limit, the direction is estimated—by an inspection of the movement and direction traces together—whence the aggregate flow of air was the greatest, and this direction is adopted for the full hour. On the average of the years 1871 to 1883, out of 8,754 hours during which the instrument was in action, 3 only had to be rejected because the direction of the wind varied more than eight points within the hour.

Method of reduction.—Hitherto we have had to speak of phenomena liable only to simple increase and decrease of value, and not subject to any change of quality. Such phenomena being properly and completely evaluated by simple numbers, we may apply to the numbers any arithmetical operations, such as averaging, and infer from the results of those operations corresponding properties of the phenomena. But we have now come to a phenomenon which requires two numbers to express it, one representing its amount and the other a varying quality; the first referring to the velocity, and the last to the direction of the wind. Here we may no longer apply arithmetical processes directly and indiscriminately to the observed numbers: but, the subject being one of motion, we must treat them according to the principles of the science of motion. These principles tell us that the motions may be equally well expressed by means of two varying numbers referring to two invariable qualities, as by a varying number referring to a varying quality; and they show us how to obtain either form of expression from the other. The invariable qualities chosen in the present case are the directions north and east, the actual wind blowing in each hour being resolved into north and east components, which may be regarded separately as the velocity of the wind in the invariable direction north or south, and the velocity of the wind in the invariable direction east or west. The resolutions are effected by means of the formulæ:—

$$\text{North component of velocity of wind} = m \cos (n \times 22\tfrac{1}{2}^\circ),$$
$$\text{East component of velocity of wind} = m \sin (n \times 22\tfrac{1}{2}^\circ),$$

* A more detailed account of the Colába anemograph will be found in the "Bombay Magnetical and Meteorological Observations, 1865 to 1870," Appendix I., page 199.

where m is the movement observed, and n the number of the direction space under which the wind of the hourly interval is classed. When the sign of either of these calculated quantities is negative, it implies that the wind blows from the opposite direction, *i. e.* from south or west. The calculations are readily made by means of tables to the nearest tenth of a mile of velocity per hour. Having now substituted the two equivalent winds for the real one, we may with propriety proceed to combine together numbers of observations by algebraical addition and averaging, treating the north and east components of the wind each by themselves. The averages thus found from the observations of any given period will represent the velocity with which the wind must blow from the northward (from the southward if the sign of the average be negative) continuously for the whole period, in order that the total movement of the wind from that direction may be the same as the total movement from the same direction produced by the winds which actually blow, and similarly the velocity with which it must blow continuously from the eastward (westward if the sign of the average be negative).

No corrections have been applied to the anemograph tabulations on account of friction.

Rain Gauges.—Newman's rain gauge, which has been in use since 1845, is made of copper and exposes for the collection of rain-drops a circular surface of an average diameter of 12·035 inches, forming the top of a funnel, which opens into a cylindrical vessel below, having a diameter of 5·732 inches: a float of slightly less diameter, so as to rise and fall freely, rests upon the water in this vessel, and having a wholly convex external surface, it allows the rain as it falls to flow off and raise the level of the water and with it the float. To the middle of the float is fixed a wooden rod, graduated with divisions, each of which represents ·05 inch of rain; and the readings of this scale, which are easily estimated to fifths of a division, are made where it is cut by the upper edge of a light brass rod placed horizontally across the mouth of the funnel, but half an inch below the edge of the exposed circular surface; the scale passes through a hole in the middle of the horizontal rod, and is thus kept always in a vertical position. The range of the scale is from 0 to 4·00 inches, and the readings of the scale have been entered in the meteorological register and the differences been taken for every interval between successive observations: the rain has accumulated in the vessel generally till the reading was somewhere above 2·00 inches, when the water was let out, by means of a brass cock at the bottom, till the reading came down to 0·00 inch. This latter reading was also maintained during intervals of dry weather—when, from evaporation, the scale would otherwise have fallen lower—by pouring small quantities of water into the gauge: the reason of this is obvious, as, if some water were not always retained, the float would sometimes rest on the bottom of the vessel and so cease to perform its function of rising equally for equal increments of rain. The scale on the wooden rod was graduated so as to agree approximately with the data—the diameters of the gauge and measuring vessel—given above. The error of the scale according to which the rod was graduated was less than a thousandth of the whole.

Newman's gauge stands on a large rectangular block of stone, in a position intermediate between the Entrance Gate, the Magnetical Observatory, and the Thermograph Shed, where the altitude of the highest neighbouring object, as seen from the gauge, is about 30°. It is supported by three feet, which are embedded with lead in holes cut in the stone block, and its circular mouth is at a height of 4½ feet above the ground and about 35 feet above the mean sea level.

Photographic rain gauge.—A description of this instrument also will be found in the Introduction to the "Bombay Magnetical and Meteorological

Observations, 1871 to 1878," page xlvi. In 1895 the syphon discharges were received in glass bottles and measured by means of a graduated glass tube and a marked glass bottle holding exactly half an inch of rain.

It was mentioned in former years that the occurrence of the discharging action of the syphon was occasionally liable to some uncertainty—the water at times trickling over the bend of the tube in considerable quantities before the proper discharge commenced. After trial of many modifications in the form of the syphon one was at last hit upon, which is free from this fault, and by which the tube is, moreover, kept in a satisfactorily clean condition from beginning to end of the monsoon, simply by the washing that takes place in the ordinary automatic discharges. Since November 1884, when the new syphon was brought into use, the discharges have been regular and unfailing except on two occasions, *viz.*, on the 18th June and 5th November 1890 when trickling again occurred: this was traced, in the last case, to the presence near the bend of the syphon tube of a living cockroach. To prevent this from occurring again, a lid of zinc was fitted to the discharge pipe at its entry into the receiving bottle, so as to cover the mouth of the bottle. To prevent birds alighting upon the funnel, and choking it with their droppings, a conical arrangement of pointed iron spikes surrounding the funnel was attached in 1882, and was found to be effective.

Constants for converting syphon discharges into inches of rainfall.—As the surface exposed by the rain gauge funnel is 50·286 square inches, an inch of rain contains 823·955 cubic centimeters. With the aid of a cubic centimeter measure,* 412 cubic centimeters of water were poured into a narrow-necked glass bottle, and a file mark was made on the bottle neck at the level up to which the water rose. A glass tube was also graduated by means of the same cubic centimeter measure, so as to read off thousandths of an inch of rain with ease. The bottle is filled as often as there have been discharges from the rain gauge syphon, and the final excess or defect is measured with the graduated tube. The use of the bottle began on 31st July 1879 and continued till the 26th July 1884, when it was accidentally broken. An exact copy of it, which had been prepared beforehand, was then substituted for the original bottle, and this copy is still in use.

Measurement and distribution of syphon discharges.—The discharges are measured daily, or oftener during heavy rainfall, and are of course always of an integral number. For each measurement the average value of a discharge is attributed to each of the intervals of time, shown on the rain curve, between pairs of successive discharges; and it remains then only to distribute this quantity, for each filling of the receiving vessel, by means of tabulations of the ordinates of the rain curve. When, as is often the case, the rate of fall of the rain at the time of a discharge exceeds $1\frac{1}{8}$ inch per hour, it is necessary to allow for the rain that enters the receiving vessel during the known time (16 seconds) of discharge, the allowance depending on the rate of rainfall, which is easily estimated for this purpose by noting, with the aid of an appropriate paper scale, the inclination of the rain curve immediately after the time of discharge. The aggregate of such allowances is deducted from a day's (or other) measurement before dividing the quantity equally amongst the several intervals.

Determination of scale of rainfall ordinates.—The factor for converting ordinates of the rainfall curve into inches of rainfall was found by experiments in which a determined weight or volume of distilled water was poured into the receiving vessel, and the change of length of the ordinate produced thereby

* Lent by Mr. F. Chambers, whose verification data show it to be accurate to a thousandth of the 100 cubic centimeters which it is designed to measure.

was carefully measured. In an experiment made on the 22nd May, 1895, the quantity of water poured into the vessel was equivalent to ·480 inch of rain, and the change of length of the ordinate ·479 of a true inch; whence the factor is found to be 1·002, which is applicable to all the rainfall registrations of the year 1895.

The tabulations are made with the true-inch scale of the thermograph tabulating instrument, using the white line as datum; and the reading of this datum that shall correspond to the reading ·000 of the rain curve, when the receiving vessel has just been discharged, is re-determined whenever the adjustment of the recording apparatus is disturbed. For this purpose an average is taken of a number of measurements for all of which the rain is falling very slowly at the time of the syphon's coming into action and for a short time longer. It is necessary to select such occasions, because at times of heavy rainfall the curve has risen sensibly before the light has had time to make a distinct impression on the sensitive paper. The mode of tabulating is (1) to set the scale on the constant reading corresponding to the white line, (2) to move the sliding piece until the index is set upon the white line, and (3) to move the sliding bar till the index is set upon the curve, and then read the scale. By setting the paper carefully, so that a considerable length of the white line is practically parallel to the lateral motion of the frame, the repetition of the first two operations of tabulation is avoided until many hourly ordinates have been read; and then a new setting of the paper is made for another stretch of the white line.

(*b*). Magnetical Instruments, 1895.

Kew Unifilar Magnetometer.—A description of this instrument, with which the observations of absolute declination and of horizontal intensity for the year 1895 have been taken, will be found on pages xxxiii to liii of the Introduction to the "Bombay Magnetical and Meteorological Observations, 1865—70"; the description includes also an account of the situation of the instrument, of the nature and routine of the observations taken with it—with examples of observation and computation forms filled up with the figures of actual observations—and of the formulæ of reduction and the constants involved in them.

The entries in columns 1 to 17 and 19 of the Tables of Observations of Absolute Horizontal Force are copied directly from the computation form: column 18 is given to show the degree of accordance existing in the determinations from deflections with the deflecting magnet at the respective distances 0·8 foot and 1·0 foot from the deflected magnet; and the numbers in column 21 are the products of those in column 20 multiplied by the constant number ·46108.

The description, referred to above, of the observation of absolute declination will render clear the meaning of the numbers entered in each column of the Tables of Observations of Absolute Declination: all of these, except the monthly means in columns 12 and 13, are taken directly from the observation form.

Kew Dip Circle.—A description of this instrument, and of the mode of using it, is also given in the Introduction to the "Bombay Magnetical and Meteorological Observations, 1865—70," pages lvi to lix, and the following additional or corrective remarks will make it applicable to the observations of 1895:—

(1) The place of observation has been the top room of the Electrometer Tower, the dip circle having been placed on the same pillar on which the Kew unifilar magnetometer is placed in the regular observations of absolute horizontal force and absolute declination. The reading of the azimuth circle adopted for this place has in-

variably been 63° 31′. An observation for the verification of this reading was made on the 22nd February 1881.

(2) The dip needles used during the year 1895 have been as follows:—
For the regular observations:—
Dover, Charlton No. 1.
„ „ No. 2.
And for supplementary observations:—
John Dover No. $\frac{1}{81}$.
„ „ No. $\frac{2}{81}$.

(3) The final cleaning of the axles of the needles has throughout been made with a clean silk cloth.

(8). Processes of Reduction and Description of the Tables of Meteorological Results, 1895.

Pressure of Vapour and additional capacity of the Air.—Having obtained from the tabulations of the barograms and thermograms hourly values of barometric pressure, temperature of the air, and temperature of evaporation, the pressure of vapour was calculated for each hour with the aid of a table by the formula

$$f''=f'-\cdot01147\ (t-t')\times\frac{P-f'}{30}$$

in which t and t' denote the temperatures of the air and wet bulb thermometers respectively, f'' and f' the pressure of vapour at the temperature of the dew point and at temperature t', and P the barometric pressure. The values of the pressure of vapour at different temperatures were taken from the following table, the numbers in which have been extracted from Boileau's Collection of Tables:—

Table 1.—*Regnault's values of the Pressure of Vapour at different Temperatures.*

Temperature.	Pressure of vapour.	Temperature.	Pressure of vapour.	Temperature.	Pressure of vapour.	Temperature.	Pressure of vapour.	Temperature.	Pressure of vapour.	Temperature.	Pressure of vapour.	Temperature.	Pressure of vapour.	Temperature.	Pressure of vapour.
o	Inch.	o	Inch.	o	Inch.	o	Inch.	o	Inch.	o	Inch.	o	Inch.	o	Inch.
35	·204	43	·278	51	·374	59	·500	67	·662	75	·868	83	1·128	91	1·455
36	·212	44	·288	52	·388	60	·518	68	·685	76	·897	84	1·165	92	1·501
37	·220	45	·299	53	·403	61	·537	69	·709	77	·927	85	1·203	93	1·548
38	·229	46	·311	54	·418	62	·556	70	·733	78	·958	86	1·242	94	1·597
39	·238	47	·323	55	·433	63	·576	71	·758	79	·990	87	1·282	95	1·647
40	·248	48	·335	56	·449	64	·596	72	·784	80	1·023	88	1·324	96	1·698
41	·257	49	·348	57	·466	65	·617	73	·811	81	1·057	89	1·366	97	1·751
42	·267	50	·361	58	·482	66	·639	74	·839	82	1·092	90	1·410	98	1·805

To find the additional capacity of the air the pressure of vapour was deducted from the number in the above table standing opposite to the temperature of the air.

Barometric Pressure.—In Table I is shown, for every day in the year, the mean of 24 hourly tabulations of the barograph, corrected* to agree with Newman's barometer No. 58;—also the mean pressure for each month and each year, and the excess of each monthly mean above the annual mean for the same year; and the principal features of the annual variation are indicated

* In the manner described in paragraph 54 of the Introduction of the "Bombay Magnetical and Meteorological Observations for 1871 to 1878."

at the foot of the table. The maximum and minimum daily pressures in each month are distinguished by being printed in strong figures.

Temperature of the Air, &c.—The plan of the following tables is the same as that of Table I, but the subjects of them and the sources from which the numbers are obtained and the mode of obtaining them are as stated below:—

Table II.—Temperature of the air: derived from hourly tabulations of the thermograph dry-bulb.

Table III.—Pressure of vapour: derived from hourly tabulations of the thermograph dry-bulb and wet-bulb, and of the barograph; and calculated in the manner described above.

Table IV.—Additional capacity of the air: derived from hourly differences between the pressure of vapour corresponding to the temperature of the air and the calculated actual pressure of vapour.

Table VII.—Velocities of the north and east components of the wind: derived from hourly tabulations from the register of the Robinson-Beckley anemograph.

Table VIII.—Velocity of the wind regardless of direction: derived from hourly tabulations from the register of the Robinson-Beckley anemograph.

Table XI.—Extent of cloudy sky: derived from estimations made at the hours 6, 10, 14, 16 and 22 daily.

Tables VI and XII are on the same plan as Table I, except that the entries made in them are aggregates—daily, monthly and yearly—instead of mean values; and they are sufficiently explained by their several headings.

Monthly and annual range of variation of Meteorological Elements.—Table V shows the extreme limits between which the oscillations of barometric pressure, temperature of the air, pressure of vapour, and additional capacity of the air were confined in each month and in the whole year, and also the ranges of the respective oscillations.

The numbers in Table IX are derived from hourly tabulations from the register of the Robinson-Beckley anemograph. The temperatures of the ground given in Table X are derived from the readings of the several thermometers, made five times a day as regards the 1 inch and 9 inches deep thermometers, and once a day as regards the 20 inches, 60 inches and 132 inches deep thermometers. The five-day means of Table XIII are derived from hourly tabulations of the barograph (combined with readings of Newman's barometer No. 58) and thermograph, from the measurements in Newman's rain-gauge, and from hourly tabulations from the register of the Robinson-Beckley anemograph. The rainfall of Table XIV is that received in Newman's gauge. In other respects these tables require no explanation beyond their titles, the headings of the several columns, and the foot notes.

(9) Notes on instrumental changes and on all irregularities or departures from the routine of observation or reduction in 1895.

Robinson-Beckley Anemograph.—Substituted endless screw of windmill vanes and made preliminary trials and measurements on May 2, 7, 8 and 12. External parts painted on May 21 and November 22. The aggregate of all the interruptions of the instrument in the year 1895 was $9^h\ 45^m$: the loss of record was, however, rarely complete, and values partly or entirely interpolated have been inserted whenever the interruption was not somewhat prolonged. To aid in the making of interpolations, it has been customary, whenever the action of the instrument was voluntarily interrupted for more than one hour, to observe the direction of the wind by estimation, and to record the readings of a small

auxiliary velocity measurer put up for the occasion. No complete day's records have been omitted in the formation of monthly abstracts.

When for any reason the traces furnished by the photographic self-registering instruments are interrupted, and the interruption includes the moments when one or more hourly tabulations should be made, these last are either substituted by the corresponding eye-observations, if the hours should happen to be any of the five regular observation hours, or if special eye-observations were taken for the purpose, or else, if no eye-observations are available, they are interpolated. In the last case, if the interruption lasts for less time than one hour, the interpolation is made on the assumption that the rate of change of the phenomenon from its value at the beginning to its value at the end of the interruption was uniform, providing that the parts of the curve immediately preceding and immediately following the gap were, in appearance, continuations of the straight line connecting the extremities of the gap. If the last condition is not satisfied, or if the gap, taking account of points inserted by means of eye-observations, is of greater length than one hour, the interpolation is made between the next preceding and the next following hourly entries, first, by allowing for the known *normal* rate of change of the phenomenon between those hours in the same month, and then by assuming that any additional change, shown by the difference between the values of the phenomenon at the two extreme hours, has grown at a uniform rate. Interpolated values are entered in the abstract sheets with enclosing square brackets—inserted eye-observations between parentheses.

Barograph.—No tabulation was obtained for 17 hours of 10th December 1895 on account of a stoppage of the clock, but an eye-observation was available and was adopted.

Occasional, though rare, failure of the bi-hourly stops to act has caused no loss of record.

The aggregate of all the interruptions of the barograph in the year 1895 was $0^h\ 13^m$, and the number of hourly tabulations lost was only 1, which was substituted by an eye-observation. Short interruptions caused by the regular changing of photographic papers and by changing of lamps, if not unusally prolonged, are not included in the above aggregate, nor in the aggregates of interruptions of the thermograph that follow further on.

Thermograph dry-bulb.—The aggregate of all the interruptions of the thermograph dry-bulb in the year 1895 was only $0^h\ 51^m$. No hourly tabulation was lost.

Thermograph wet-bulb.—No tabulations were obtained for 12^h and 13^h of the 29th December 1895 on account of drying of the muslin covering of the bulb and imperfect capillary action of threads.

The aggregate of all the interruptions of the thermograph wet-bulb in the year 1895 was $11^h\ 2^m$, made up chiefly of short intervals of time occupied in cleaning and renewing the muslin coverings of the bulbs and the bundles of threads connecting them with the supply of water. The number of hourly tabulations lost was 2, but of these 1 was substituted by an eye-observation, leaving only 1 to be interpolated.

Self-registering Rain-gauge.—No hourly tabulations were lost in the year 1895.

N. A. F. MOOS,
Director.

Colába Observatory, September 1896.

TABLES OF RESULTS

DERIVED

FROM THE CONTINUOUS REGISTRATIONS OF AUTOMATIC METEOROLOGICAL INSTRUMENTS

AND FROM

METEOROLOGICAL OBSERVATIONS,

1895.

TABLES OF RESULTS

DERIVED FROM THE

METEOROLOGICAL OBSERVATIONS MADE DAILY AT 6, 10, 14, 16 AND 22 HOURS,

1895.

FIVE-DAY MEANS,

1895.

B 590—1 B

TABLE I.—Barometric Pressure, 1895.

Height of Barometer above mean Sea-level = 37 feet.

1895. Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	MONTH.											
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
1	29·908	29·912	**29·950**	29·854	29·843	29·749	29·687	29·691	29·803	29·822	**29·859**	29·949
2	·903	·935	·928	·861	·804	·764	·764	·713	·801	·808	·904	·948
3	·944	·912	·891	**·869**	·776	·760	**·769**	·702	·817	·808	·891	·913
4	·963	·873	·876	·821	**·844**	**·770**	·739	·713	·807	·870	·918	·863
5	·941	·853	·880	·773	·829	·763	·729	·687	·796	**·883**	·949	·871
6	·906	**·847**	·862	·757	·825	·748	·729	·636	·724	·876	·949	·880
7	·917	·872	·833	·746	·804	·718	·702	·575	**·689**	·851	·945	·891
8	·931	·892	·838	·804	·810	·730	·679	**·525**	·774	·827	·912	·888
9	·939	·917	·847	·820	·779	·742	·662	·571	·829	·872	·917	·880
10	·952	·989	·831	·798	·733	·725	·648	·674	·838	·880	·908	·862
11	·951	**30·011**	·830	·809	·741	·666	·631	·686	·827	·870	·943	**·846**
12	·906	29·965	·828	·796	·759	·616	·619	·655	·821	·854	·971	·852
13	**·859**	·912	·800	·829	·743	·585	·670	·662	·809	·846	·968	·940
14	·900	·920	**·769**	·858	**·716**	·595	·692	·693	·764	·813	·947	·989
15	·951	·905	·785	·858	·754	·572	·666	·712	·754	·778	·970	·970
16	·947	·898	·815	·840	·804	·486	·681	·727	·759	**·767**	**·985**	·962
17	·914	·917	·808	·834	·810	**·436**	·692	·732	·779	·769	·960	·963
18	·902	·952	·828	·802	·781	·480	·641	·753	·803	·791	·944	·966
19	·925	·955	·855	·776	·767	·547	**·616**	·762	·809	·803	·941	·978
20	·934	·929	·834	·798	·787	·527	·675	·723	·800	·824	·944	**30·008**
21	·976	·949	·822	·795	·802	·505	·739	·721	·849	·823	·941	29·984
22	**30·026**	·967	·830	·763	·809	·661	·734	·735	·874	·832	·905	·986
23	29·991	·965	·815	·744	·807	·750	·716	·761	**·882**	·804	·903	·987
24	·941	·976	·807	·745	·783	·709	·722	·737	·865	·773	·925	·989
25	·902	·945	·855	**·718**	·791	·701	·738	·702	·849	·787	·954	·976
26	·898	·918	·849	·741	·829	·706	·734	·722	·813	·809	·926	·997
27	·920	·907	·838	·787	·828	·684	·679	·755	·776	·806	·916	·985
28	·933	·943	·844	·822	·811	·640	·660	·754	·751	·789	·934	·947
29	·943		·819	·827	·786	·633	·657	·767	·745	·777	·920	·900
30	·915		·843	·842	·818	·643	·631	·785	·775	·801	·938	·906
31	·900		·836		·794		·660	**·800**		·803		·939
Monthly Mean.	29·930	29·926	29·840	29·803	29·792	**29·654**	29·689	29·704	29·799	29·820	29·933	**29·936**
Annual Variation ...	+·111	+·107	+·021	—·016	—·027	—·165	—·130	—·115	—·020	+·001	+·114	+·117

	in.
Annual mean	29·819
The greatest mean daily barometric pressure in the year (that of 22nd January) was	30·026
The least do. do. do. (that of 17th June) was	29·436
Difference =	0·590

TABLE II.—Temperature of the Air, 1895.

1895. Date.	MONTH. January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December
	°	°	°	°	°	°	°	°	°	°	°	°
1	73·6	73·9	77·6	80·8	82·8	85·0	83·1	80·2	78·9	80·8	82·0	78·8
2	72·8	72·1	**76·9**	**79·4**	82·9	85·5	**83·8**	80·9	80·1	81·6	79·6	77·5
3	73·8	**70·4**	78·2	79·6	82·9	85·7	83·8	80·5	78·8	82·4	81·4	76·9
4	75·2	70·6	78·9	80·4	83·2	85·8	83·7	79·3	78·5	81·5	**82·8**	76·2
5	**75·4**	72·0	79·9	80·0	82·6	85·9	83·6	79·5	78·8	80·6	81·4	76·7
6	75·1	70·9	**81·0**	81·5	82·8	86·2	82·9	78·1	79·5	79·9	80·8	77·0
7	75·0	71·5	80·6	81·7	**82·2**	**86·6**	82·1	77·7	**74·9**	80·3	81·4	77·3
8	74·9	71·6	80·2	81·3	83·0	86·6	80·4	**77·4**	75·9	82·4	80·8	77·4
9	74·3	71·6	78·8	80·4	82·6	86·6	78·7	80·0	78·8	83·2	80·8	76·8
10	72·9	73·2	78·6	81·0	83·9	86·5	78·5	80·4	79·1	82·5	81·5	75·4
11	72·3	72·4	78·8	81·8	85·2	85·0	79·9	80·9	78·4	82·9	82·0	**74·4**
12	72·6	71·5	79·4	80·8	85·2	81·0	79·8	80·7	79·8	81·7	81·9	74·5
13	74·2	72·7	80·5	80·9	84·9	82·5	81·1	80·5	80·8	81·8	80·8	75·4
14	74·4	74·4	80·0	81·3	84·3	81·4	80·0	80·2	79·9	83·6	79·9	75·3
15	72·7	75·0	78·7	81·8	83·9	78·9	81·9	80·3	76·1	82·6	80·1	74·4
16	71·8	74·1	77·9	81·4	84·1	80·5	79·6	80·4	77·4	82·8	80·5	75·1
17	71·6	73·8	78·4	82·0	84·2	81·4	79·4	80·6	79·4	**83·9**	80·1	76·0
18	72·1	73·9	79·2	83·9	83·9	80·1	**77·4**	**81·1**	80·6	83·2	80·6	77·1
19	73·3	78·6	79·4	**85·5**	84·6	**77·8**	78·5	81·1	80·5	80·9	81·0	77·6
20	73·4	80·7	78·9	84·5	84·9	78·1	80·4	80·8	80·6	**74·8**	81·1	77·3
21	72·0	**81·1**	79·6	83·3	84·8	80·6	81·0	78·2	80·1	78·4	80·8	77·0
22	**69·1**	80·9	79·4	82·4	84·8	82·2	81·7	79·4	79·9	80·8	81·1	76·5
23	69·5	79·0	79·4	82·7	84·4	82·5	81·6	79·6	80·3	81·0	80·3	76·8
24	72·0	78·2	79·3	82·6	84·7	82·2	81·7	79·8	79·1	78·7	79·8	76·1
25	71·5	77·3	78·4	83·0	**85·5**	81·9	79·9	79·2	79·9	80·0	80·9	75·6
26	72·1	77·3	77·9	82·9	85·0	83·3	80·9	79·3	80·1	81·6	80·6	74·8
27	73·6	77·1	79·3	82·6	85·4	83·1	80·5	80·6	80·7	81·6	79·1	75·1
28	74·1	77·4	79·4	82·3	84·8	83·3	80·2	80·2	81·8	81·4	78·5	74·9
29	74·4		80·0	82·5	84·4	83·1	80·3	81·0	**83·1**	81·1	**78·3**	76·0
30	74·4		80·1	83·0	84·9	83·4	80·6	79·0	82·9	80·9	78·5	78·4
31	73·8		80·9		85·1		80·1	79·3		81·6		**79·4**
Monthly Mean.	73·2	74·8	79·2	81·9	**84·1**	83·1	80·9	79·9	79·5	81·3	80·6	76·4
Annual Variation ...	—6·4	—4·8	—0·4	+2·3	+4·5	+3·5	+1·3	+0·3	—0·1	+1·7	+1·0	—3·2

	°
Annual mean	79·6
The greatest mean daily temperature of the air in the year (that of 7th June) was	86·6
The least do. do. do. (that of 22nd January) was	69·1
Difference =	17·5

TABLE III.—Pressure of Vapour, 1895.

1895. Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
1	0·573	0·609	0·705	**0·704**	0·840	0·877	**0·929**	0.888	0·804	0·910	0·843	0·651
2	·544	·538	·723	·722	·878	·888	·929	·881	·811	**·924**	·831	·623
3	·588	**·420**	·718	·778	·876	·914	·913	·868	·798	·885	·899	·575
4	·602	·461	·701	·763	·839	·920	·890	·876	·810	·841	**·905**	·645
5	·597	·487	·658	·791	·811	·938	·893	·868	·826	·842	·868	·695
6	·579	·494	·740	·737	·812	·934	·887	·857	·832	·835	·845	·686
7	·627	·574	·843	·751	·809	·946	·881	·857	·799	·848	·888	·656
8	·649	·571	**·849**	·842	·839	·952	·873	·861	·820	·882	·790	·617
9	·630	·565	·796	·829	·886	**·965**	·869	·886	·878	·866	·792	·633
10	·545	·617	·720	·850	·925	·944	·890	·891	·845	·821	·819	·541
11	·518	·551	·724	·860	**·956**	·949	·905	**·900**	·855	·741	·779	·514
12	·528	·515	·748	·800	·943	**·870**	·889	·882	·863	·734	·787	·545
13	·660	·579	·791	·795	·916	·937	·913	·864	·845	·804	·784	·522
14	**·665**	·676	·732	·822	·902	·922	·907	·870	·857	·817	·743	**·450**
15	·540	**·711**	·760	·837	·850	·909	·914	·872	**·793**	·854	·726	·501
16	·503	·669	·673	·821	·816	·947	·867	·884	·831	·861	·728	·571
17	·535	·642	**·652**	·851	**·766**	·954	**·864**	·880	·855	·869	·728	·637
18	·537	·632	·700	**·923**	·780	·931	·866	·869	·867	·924	·738	·672
19	·578	·685	·679	·875	·823	·871	·866	·873	·892	·865	·741	·695
20	·600	·673	·692	·885	·824	·885	·899	·865	·887	·758	·714	·647
21	·566	·683	·778	·836	·837	·905	·909	**·811**	·870	·816	·750	·642
22	**·444**	·632	·779	·865	·870	·916	·888	·866	·870	·865	·731	·632
23	·457	·683	·787	·882	·878	·928	·877	·856	·839	·879	·712	·586
24	·573	·671	·756	·850	·881	·914	·875	·855	·812	·839	·653	·546
25	·520	·650	·704	·856	·898	·916	·872	·834	·843	·863	·634	·541
26	·609	·705	·675	·812	·904	·943	·872	·829	·886	·789	**·602**	·515
27	·653	·664	·740	·818	·898	·917	·886	·858	·849	·782	·638	·505
28	·622	·660	·717	·784	·887	·934	·881	·851	·897	·742	·631	·501
29	·651		·785	·771	·831	·939	·876	·855	**·957**	**·711**	·648	·536
30	·641		·779	·830	·836	·933	·894	·834	·955	·804	·659	·653
31	·644		·787		·883		·895	·826		·793		**·752**
Monthly Mean...	**0·580**	0·608	0·738	0·818	0·861	**0·923**	0·889	0·863	0·851	0·831	0·754	0·596
Annual Variation ...	—·196	—·168	—·038	+·042	+·085	+·147	+·113	+·087	+·075	+·055	—·022	—·180

	in.
Annual mean	0·776
The greatest mean daily pressure of vapour in the year (that of 9th June) was	0·965
The least do. do. do. (that of 3rd February) was ...	0·420
Difference =	0·545

Table IV.—Additional Capacity of the Air, 1895.

1895. Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
1	0·261	0·230	0·242	0·352	0·283	0·331	0·204	0.142	0·184	0·144	0·253	0·337
2	·267	·254	·204	·285	·250	**·338**	·229	·176	**·219**	·159	·185	·326
3	·252	·329	·252	·234	·251	·321	·246	·173	·187	·223	**·177**	·355
4	·279	·298	·289	·276	·302	·317	**·266**	·127	·165	·235	·220	·267
5	·288	·305	**·366**	·236	·305	·303	·258	·139	·158	·205	·207	**·231**
6	**·298**	·269	·323	·343	·313	·318	·239	·104	·174	·190	·213	·247
7	·246	·202	·202	·339	·294	·326	·217	·091	**·067**	·190	·184	·285
8	·217	·207	**·185**	·230	·294	·317	·167	**·078**	·075	·229	·267	·331
9	·220	·215	·190	·212	**·228**	·302	·111	·138	·110	·278	·262	·293
10	·269	·204	·262	**·210**	·239	·322	·087	·147	·149	·292	·261	·342
11	·278	·246	·264	·230	·259	·256	·116	·156	·119	**·397**	·319	·345
12	·276	·261	·259	·255	·271	·192	·128	·167	·156	·357	·306	·314
13	·190	·234	·252	·264	·285	·177	·147	·176	·207	·291	·273	·368
14	·189	·182	·296	·248	·277	·151	·116	·161	·163	·342	·285	**·436**
15	·266	**·161**	·225	·253	·315	·080	·178	·163	·109	·267	·307	·359
16	·282	·178	·284	·255	·355	·095	·143	·154	·111	·265	·315	·306
17	·247	·197	·325	·246	**·409**	·117	·140	·164	·152	·295	·304	·269
18	·258	·208	·304	·244	·386	·096	**·074**	·193	·178	·214	·316	·265
19	·248	·306	·330	**·354**	·369	·081	·111	·188	·149	·195	·326	·257
20	·229	·385	·303	·303	·377	**·078**	·140	·187	·158	**·105**	·354	·294
21	·222	·387	·235	·307	·361	·140	·152	·154	·159	·157	·303	·289
22	·268	**·426**	·231	·246	·327	·186	·196	·140	·151	·187	·335	·286
23	·275	·311	·219	·238	·302	·183	·201	·158	·195	·181	·330	·343
24	·215	·303	·246	·267	·311	·188	·209	·165	·183	·146	·370	·360
25	·255	·294	·271	·274	·328	·175	·148	·164	·180	·170	·428	·354
26	·184	·236	·286	·316	·301	·196	·181	·172	·143	·294	**·450**	·355
27	**·179**	·273	·264	·301	·322	·214	·154	·187	·203	·301	·364	·374
28	·224	·285	·290	·321	·311	·206	·150	·181	·192	·336	·351	·377
29	·204		·242	·343	·351	·195	·157	**·205**	·177	·357	·328	·372
30	·212		·252	·302	·365	·211	·151	·159	·172	·254	·323	·326
31	·191		·270		·326		·134	·176		·290		·256
Monthly Mean.	0·242	0·264	0·263	0·276	0·312	0·214	0·166	**0·158**	0·158	0·244	0·297	**0·320**
Annual Variation ..	—·001	+·021	+·020	+·033	+·069	—·029	—·077	—·085	—·085	+·001	+·054	+·077

	in.
Annual mean	0·243
The greatest mean daily additional capacity of the air in the year (that of 26th November) was.	0·450
The least do. do. do. (that of 7th September) was.	0·067
Difference =	0·383

Maxima and Minima of different Meteorological Elements, 1895.

TABLE V.—*In which are collected the individual observations in each month of the year, which showed the greatest and the least values of the following elements, viz., Height of Barometer, corrected for Temperature; Temperature of Air; Pressure of Vapour; and Additional Capacity of Air.*

1895.	Height of Barometer.			Temperature of Air.			Pressure of Vapour.			Additional Capacity.		
Month.	Greatest.	Least.	Range.	Greatest.	Least.	Range.	Greatest.	Least.	Range.	Greatest.	Least.	Range.
	in.	in.	in.	°	°	°	in.	in.	in.	in.	in.	in.
January...	30·105	29·806	0·299	83·0	62·0	21·0	0·751	0·351	0·400	0·614	0·071	0·543
February .	·090	·788	·302	90·1	63·2	26·9	·857	·333	·524	·856	·057	·799
March ...	·015	·709	·306	86·7	72·6	14·1	·918	·505	·413	·630	0·94	·536
April ...	29·939	·662	·277	90·9	75·4	15·5	·977	·503	·474	·639	·100	·539
May ...	·917	·666	·251	90·1	78·9	11·2	·994	·696	·298	·588	·112	·476
June ...	·824	·390	·434	91·6	76·0	15·6	1·020	·792	·228	·555	·046	·509
July ...	·807	·569	·238	87·0	75·4	11·6	0·990	·811	·179	·366	·037	·329
August ...	·844	·495	·349	84·4	74·7	9·7	·955	·733	·222	·292	·038	·254
September.	·930	·637	·293	86·8	72·0	14·8	1·030	·719	·311	·367	·040	·327
October ...	·957	·684	·273	92·3	73·6	18·7	0·991	·526	·465	·989	·052	·937
November.	30·053	·796	·257	88·8	72·6	16·2	·987	·492	·495	·812	·080	·732
December.	·086	·788	·298	86·6	67·5	19·1	·853	·353	·500	·850	·106	·744
Year ...	30·105	29·390	0·715	92·3	62·0	30·3	1·030	0·333	0·697	0·989	0·037	0·952

Rainfall, 1895.

TABLE VI.—*Total fall of rain (in inches) as measured by F. Chambers's Self-registering Gauge, the funnel of which is 28 feet above the ground.*

1895. Date.	MONTH. January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
		in.			in.	in.	in.	in.	in.	in.	in.	
1	...	...	...	...	...	...	0·25	0·09	0·07	...	...	...
2	...	...	...	...	...	...	...	0·08	0·03	...	0·03	...
3	...	...	...	...	...	...	...	0·23	0·02	...	...	...
4	...	...	...	...	...	...	...	0·38	0·01	...	...	...
5	...	...	...	...	...	...	0·06	0·49	0·05	...	...	...
6	...	...	...	...	...	...	0·17	1·32	0·01	...	...	...
7	...	...	...	...	...	...	0·07	**5·72**	**6·44**	...	...	...
8	...	...	...	...	...	...	0·27	2·89	1·05	0·02	...	...
9	...	...	...	...	...	...	0·25	0·16	0·07	...	...	...
10	...	...	...	...	...	0·11	**3·22**	0·12	0·43	...	...	...
11	...	...	...	...	...	0·03	1·29	0·03	0·21	...	...	...
12	...	...	...	...	...	0·26	0·08	0·01	...	...	...	...
13	...	...	...	...	...	0·99	0·32	...	...	...	...	...
14	...	...	...	...	...	0·99	0·77	0·23	0·55	...	...	...
15	...	...	...	...	...	1·81	0·10	0·22	0·50	...	...	...
16	...	...	...	...	...	1·35	0·68	0·11	0·65	...	...	...
17	...	...	...	...	...	1·11	1·04	...	...	...	...	...
18	...	...	...	...	0·01	1·21	2·91	0·24	...	...	...	...
19	...	...	...	...	...	1·82	1·93	0·01	0·30	0·38	...	...
20	...	...	...	...	...	**5·01**	0·35	0·02	0·01	0·76	...	...
21	...	...	...	...	...	1·18	0·23	0·31	0·02	0·10	...	...
22	...	...	...	...	...	0·10	0·07	0·38	0·52	...	...	...
23	...	...	...	...	...	0·22	0·01	0·27	...	0·23	...	...
24	...	...	...	...	...	0·28	0·08	0·46	...	**1·82**	...	...
25	...	...	...	...	...	0·08	0·36	0·36	0·02	0·02	...	...
26	...	...	...	...	...	0·01	0·07	...	0·36	...	...	...
27	...	...	...	...	...	0·03	0·28	0·21	...	...	...	...
28	...	...	...	...	**0·06**	0·01	0·42	0·17	...	...	...	...
29	...	...	...	...	...	...	1·35	0·02	...	...	...	...
30	...	...	...	...	...	...	0·20	0·57	...	...	...	...
31	...	...	...	...	...	...	0·07	0·26	...	...	...	...
Monthly Total.	...	0·08	...	...	0·07	16·60	**16·90**	15·36	11·32	3·33	0·03	...
Number of rainy days.	...	1	...	...	2	19	**28**	28	20	**7**	**1**	...

Total fall of rain in the year ... ... 63·69 inches.
Total number of rainy days in the year 106
The greatest daily fall of rain in the year (that of 7th September) was ... ... 6·44 inches.
No rain fell in the months of January, March, April, and December, nor on any of the days left blank in the above table.

Mean Daily Velocities of the North and East Components of the Wind, 1895.

TABLE VII.—*Showing the Mean Velocities of the North or South and East or West Components of the Winds which blew on each day of the year 1895.*

In Miles per Hour.

1895.	MONTH.																							
Date.	January.		February.		March.		April.		May.		June.		July.		August.		September.		October.		November.		December.	
	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.
1 ...	9·8 N	2·2 W	5·2 N	1·1 W	5·7 N	6·3 W	11·7 N	7·1 W	9·0 N	11·5 W	4·9 N	9·5 W	3·2 S	16·7 W	6·5 S	17·4 W	0·5 S	8·9 W	5·5 S	2·1 E	0·2 N	0·7 E	4·0 N	2·0 E
2 ...	7·2 N	1·3 W	8·2 N	0·2 W	8·3 N	5·2 W	11·1 N	8·3 W	6·6 N	10·3 W	3·0 N	9·7 W	0·2 S	10·8 W	6·0 S	13·5 W	3·9 N	9·6 W	6·2 S	0·7 W	0·9 N	3·5 E	6·7 N	1·5 E
3 ...	4·2 N	1·5 E	13·5 N	4·4 W	9·6 N	5·3 W	9·2 N	6·9 W	5·9 N	7·6 W	3·6 N	7·8 W	0·1 S	10·3 W	7·6 S	13·4 W	0·2 N	7·0 W	1·0 S	4·2 W	6·4 N	0·8 E	8·6 N	0·8 W
4 ...	2·4 N	0·5 E	10·6 N	3·1 W	12·5 N	7·8 W	10·1 N	6·6 W	1·5 S	6·9 W	3·8 N	7·4 W	1·8 S	15·4 W	6·0 S	13·6 W	2·3 N	5·0 W	0·2 S	2·7 W	1·5 N	0·9 E	4·6 N	0·4 E
5 ...	2·1 N	1·3 E	10·6 N	3·6 W	9·7 N	3·9 W	7·9 N	7·0 W	2·3 N	7·1 W	6·8 N	9·0 W	5·6 S	17·6 W	6·5 S	17·3 W	2·6 N	4·3 W	7·1 N	1·2 W	4·8 N	0·7 W	3·3 N	0·6 E
6 ...	3·5 N	0·9 E	5·9 N	3·1 W	2·4 N	1·9 W	5·6 N	5·2 W	0·4 S	7·0 W	4·2 N	7·4 W	5·5 S	16·6 W	5·4 S	16·1 W	6·6 N	10·9 W	9·4 N	1·7 W	4·4 N	1·2 W	5·8 N	0·7 E
7 ...	5·2 N	0·8 W	0·3 N	1·3 W	4·8 S	2·2 W	7·1 N	5·0 W	1·1 N	6·7 W	3·8 N	6·1 W	4·5 S	10·9 W	1·0 S	20·8 W	0·7 N	18·5 W	7·8 N	3·1 W	6·6 N	1·8 W	7·2 N	0·3 E
8 ...	4·9 N	3·9 W	4·1 N	3·7 W	6·0 S	2·9 W	4·4 S	5·0 W	2·0 N	7·0 W	6·4 N	7·1 W	9·9 S	2·6 W	5·2 S	21·5 W	5·9 S	5·5 W	6·2 N	1·3 W	5·3 N	0·9 W	3·4 N	2·5 E
9 ...	4·7 N	0·6 E	3·1 N	2·9 W	0·2 S	3·7 W	3·5 S	3·4 W	2·9 N	6·7 W	4·8 N	8·9 W	13·3 S	1·7 W	8·8 S	17·0 W	5·4 S	4·0 W	3·1 N	1·8 E	3·1 N	0·7 E	3·8 N	0·4 E
10 ...	10·3 N	2·5 W	2·0 N	0·0	6·1 N	5·2 W	4·7 S	4·2 W	0·1 N	6·2 W	6·4 N	7·3 W	8·2 S	4·9 W	5·8 S	14·2 W	1·1 N	7·2 W	0·9 N	0·8 E	3·7 N	0·1 E	2·4 N	1·0 E
11 ...	12·1 N	3·1 W	8·9 N	2·8 W	12·5 N	5·7 W	5·6 S	4·1 W	7·7 S	5·5 W	4·4 N	3·9 W	9·1 S	0·4 W	0·7 S	14·9 W	3·0 S	3·4 W	5·7 N	5·7 E	2·9 N	1·2 E	3·8 N	1·9 E
12 ...	12·3 N	3·0 W	10·7 N	2·8 W	10·4 N	5·5 W	3·0 S	4·5 W	10·5 S	8·2 W	2·4 N	3·4 E	18·3 S	0·6 E	9·3 S	18·0 W	2·5 N	2·7 W	4·0 N	2·2 E	5·2 N	0·3 E	7·3 N	0·4 E
13 ...	1·0 S	1·9 W	6·4 N	2·3 W	7·0 N	5·5 W	2·2 S	4·1 W	2·7 S	7·6 W	1·6 S	3·5 W	19·1 S	3·9 W	7·3 S	17·5 W	6·8 N	5·5 W	4·8 N	3·1 E	4·5 N	0·6 W	5·8 N	4·3 E
14 ...	0·7 N	2·3 W	1·5 N	2·1 W	7·7 N	7·6 W	5·1 N	6·2 W	9·1 N	7·3 W	24·0 S	0·9 W	8·4 S	8·0 W	6·7 S	9·7 W	4·7 N	5·3 W	3·3 N	1·3 E	6·5 N	0·0	2·5 N	5·4 E
15 ...	10·8 N	1·6 W	0·8 N	2·3 W	10·0 N	9·0 W	1·5 N	5·8 W	2·7 N	7·7 W	26·0 S	2·0 E	6·5 S	17·3 W	5·9 S	14·5 W	4·1 S	0·2 W	2·5 N	1·2 E	3·6 N	0·8 E	5·0 N	3·2 E
16 ...	11·6 N	3·3 W	6·5 N	5·2 W	11·2 N	6·6 W	5·2 N	5·5 W	3·8 N	8·9 W	29·6 S	1·8 E	7·5 S	20·4 W	6·4 S	13·5 W	1·9 S	0·2 E	1·1 N	1·6 E	0·9 N	2·4 E	6·3 N	1·9 E
17 ...	12·5 N	4·0 W	6·2 N	1·3 W	12·7 N	7·3 W	5·8 N	6·8 W	2·7 N	10·9 W	22·5 S	2·3 W	7·6 S	23·3 W	5·5 S	12·1 W	4·0 S	0·9 W	1·0 N	0·8 E	3·5 N	0·1 W	5·1 N	0·8 E
18 ...	9·5 N	2·1 W	10·3 N	4·7 W	10·4 N	7·0 W	6·8 N	6·1 W	0·8 N	9·1 W	7·4 S	0·7 E	3·6 S	17·6 W	2·1 S	13·0 W	0·4 S	3·1 W	1·0 N	1·3 W	4·5 N	0·0	4·8 N	1·9 E
19 ...	8·3 N	0·2 E	5·4 N	0·5 E	6·3 N	3·3 W	4·6 N	7·1 W	0·1 S	10·3 W	11·7 S	4·8 W	5·9 S	7·8 W	1·5 N	13·0 W	5·2 N	3·1 W	3·1 S	4·9 E	1·8 N	3·0 E	2·8 N	1·2 E
20 ...	5·4 N	1·9 W	5·4 N	6·3 E	7·2 N	4·7 W	2·5 S	6·3 W	0·4 S	10·4 W	11·0 S	15·3 W	6·9 S	10·3 W	0·0	11·6 W	4·4 N	2·8 W	0·4 N	9·2 E	4·2 N	1·4 E	3·3 N	1·7 E
21 ...	11·4 N	1·6 W	1·6 N	7·2 E	4·3 N	5·6 W	3·5 N	7·3 W	0·2 N	8·9 W	24·3 S	8·4 W	5·5 S	11·5 W	2·7 S	5·6 W	2·3 N	3·8 W	5·3 N	9·8 E	5·1 N	0·2 E	4·7 N	1·2 E
22 ...	10·4 N	4·9 W	7·0 N	2·5 E	5·3 N	5·6 W	5·4 N	7·0 W	0·0	9·4 W	12·3 S	11·6 W	7·1 S	17·1 W	3·0 S	6·6 W	5·6 N	3·8 W	1·9 N	0·2 W	5·6 N	1·3 E	4·2 N	1·9 E
23 ...	5·2 N	1·2 E	3·1 N	1·6 W	4·0 N	7·0 W	5·6 N	7·4 W	1·2 S	6·9 W	5·3 S	11·2 W	7·4 S	18·2 W	1·2 S	12·8 W	7·9 N	6·7 W	2·3 S	2·8 W	4·6 N	4·2 E	6·5 N	4·3 E
24 ...	6·1 N	1·1 W	4·7 N	1·8 W	8·0 N	9·2 W	3·9 N	6·9 W	1·2 S	5·8 W	6·0 S	14·3 W	7·9 S	20·1 W	2·2 S	12·7 W	6·9 N	6·5 W	6·3 S	5·2 E	4·5 N	2·3 E	7·3 N	3·5 E
25 ...	6·5 N	2·8 W	4·9 N	1·4 W	10·5 N	7·0 W	3·2 N	6·9 W	2·6 S	7·9 W	6·1 S	14·1 W	5·9 S	19·0 W	1·3 N	10·4 W	7·3 N	6·0 W	4·4 N	5·7 E	3·2 N	7·4 E	6·7 N	6·4 E
26 ...	3·7 N	3·1 W	4·2 N	3·5 W	9·1 N	5·6 W	0·1 S	7·2 W	1·0 S	6·9 W	5·2 S	16·5 W	1·1 S	19·5 W	0·5 S	11·1 W	2·5 N	0·7 W	6·1 N	0·4 E	3·4 N	8·3 E	5·1 N	2·4 E
27 ...	4·9 N	2·0 W	6·0 N	2·4 W	11·6 N	9·6 W	0·2 S	6·9 W	0·8 S	9·5 W	6·2 S	15·5 W	0·0	20·3 W	0·8 S	9·8 W	3·0 N	1·0 E	6·8 N	2·5 E	5·8 N	5·5 E	4·6 N	3·1 E
28 ...	6·7 N	3·0 W	6·2 N	4·8 W	13·5 N	9·0 W	2·3 N	7·5 W	0·2 N	8·7 W	7·1 S	14·5 W	8·3 S	21·3 W	0·7 S	12·7 W	1·6 N	2·0 W	6·7 N	3·7 E	4·3 N	2·9 E	6·1 N	3·0 E
29 ...	7·1 N	2·3 W			9·8 N	7·4 W	0·5 N	7·0 W	0·1 N	7·9 W	7·9 S	12·2 W	7·6 S	18·3 W	6·4 S	16·2 W	3·5 N	1·1 W	6·0 N	1·1 E	5·5 N	1·7 E	7·8 N	4·4 E
30 ...	7·6 N	3·1 W			5·6 N	5·6 W	3·6 N	8·5 W	0·7 N	6·7 W	5·3 S	14·3 W	6·0 S	20·1 W	4·2 S	14·1 W	1·0 S	0·4 W	1·5 N	0·7 E	5·3 N	2·2 E	5·5 N	3·1 E
31 ...	4·4 N	2·4 W			9·9 N	6·8 W			3·0 N	7·7 W			7·5 S	19·7 W	3·4 S	9·1 W			4·6 N	1·8 W			1·4 N	0·5 E
Monthly Mean ...	6·8 N	1·7 W	5·8 N	1·6 W	7·4 N	6·0 W	3·1 N	6·3 W	0·4 N	8·0 W	5·5 S	7·9 W	6·8 S	13·6 W	3·7 S	13·7 W	1·9 N	4·6 W	2·5 N	1·4 E	4·1 N	1·5 E	5·0 N	2·1 E
Annual Variation ...	5·1 N	3·2 E	4·1 N	3·3 E	5·7 N	1·1 W	1·4 N	1·4 W	1·3 S	3·1 W	7·2 S	3·0 W	8·5 S	8·7 W	5·4 S	8·8 W	0·2 N	0·3 E	0·8 N	6·3 E	2·4 N	6·4 E	3·3 N	7·0 E

The Velocities of the Mean Components for the year are 1·7 N. and 4·9 W.

Velocity of Wind, 1895.

TABLE VIII.—*Mean Velocity of the Wind, in miles per hour, without regard to the direction from which it blew, for each Day of Bombay Civil Time: also the Mean Monthly Velocity, and its Variation from the Mean of the year.*

1895. Date.	January.	February.	March.	April.	May.	June.	July.	August.	September	October.	November	December.
	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.
1	11·4	7·3	9·1	14·6	**15·2**	11·0	17·3	18·7	10·7	8·2	6·5	11·0
2	9·2	11·7	10·7	**15·0**	12·5	10·5	10·8	14·9	10·5	8·1	10·9	8·8
3	7·9	**15·3**	11·5	12·9	11·6	8·7	**10·3**	15·7	8·4	**5·7**	9·0	10·6
4	9·7	12·1	15·2	13·2	7·9	8·6	15·7	15·0	7·2	6·7	6·0	**7·2**
5	8·1	12·3	11·9	11·6	7·9	12·0	18·7	18·6	8·8	9·9	6·9	7·4
6	7·1	8·7	7·0	9·9	7·9	9·4	17·8	17·3	13·8	11·6	6·5	9·1
7	8·5	**5·2**	7·2	9·9	7·2	9·1	12·0	21·0	**20·3**	9·2	8·7	10·2
8	7·5	7·7	8·5	9·8	8·1	10·5	11·8	**22·5**	10·7	8·5	7·2	8·7
9	8·2	6·8	**6·2**	7·5	7·7	11·2	15·0	19·4	8·0	9·2	**5·7**	7·4
10	12·8	7·5	9·5	8·2	6·6	11·2	13·5	15·5	8·3	7·3	7·5	7·8
11	**13·7**	11·5	14·6	9·2	10·3	9·6	10·8	15·1	8·4	11·2	8·5	7·6
12	13·1	12·9	12·5	**6·9**	14·7	8·3	19·6	18·0	8·4	9·9	8·6	9·7
13	**5·8**	8·5	9·9	7·7	8·5	**6·7**	20·4	19·0	9·7	9·8	6·9	10·5
14	6·2	5·4	12·5	10·2	7·5	25·1	14·1	12·1	8·4	7·0	8·5	11·0
15	12·7	6·9	14·9	10·5	8·5	27·2	18·6	15·7	9·8	6·6	6·1	8·7
16	13·1	10·3	14·1	9·8	9·9	**30·7**	21·9	15·1	7·2	8·1	6·6	12·3
17	13·6	8·9	16·0	9·7	11·5	23·9	**24·8**	13·4	7·9	8·3	6·6	8·4
18	11·0	12·7	14·0	9·9	9·3	14·6	19·3	13·4	6·3	7·8	7·5	8·5
19	11·1	8·7	9·8	9·4	10·3	16·6	11·5	13·2	7·4	11·1	9·2	7·7
20	8·1	10·7	10·4	8·9	10·5	19·6	12·9	11·6	6·8	11·0	8·7	7·5
21	12·5	13·1	8·1	9·7	9·1	26·1	13·2	**8·2**	6·4	**13·2**	9·9	8·7
22	12·4	9·9	8·8	9·5	9·4	17·0	18·5	10·2	7·0	5·6	10·6	8·2
23	8·8	7·5	8·3	10·5	7·1	12·5	19·8	13·4	10·7	6·7	11·2	11·0
24	11·6	8·0	13·2	8·9	**6·1**	15·6	21·6	13·6	9·6	11·7	10·0	11·0
25	8·8	8·0	13·7	9·0	8·8	15·4	20·2	10·7	9·7	10·7	11·2	12·2
26	6·1	7·6	12·6	7·6	7·2	17·5	19·7	11·3	9·3	11·0	**11·9**	10·3
27	7·7	8·6	15·7	7·0	9·7	16·8	20·3	10·7	6·5	10·6	11·2	11·1
28	8·5	9·2	**17·0**	8·2	8·9	16·7	22·9	13·1	**5·7**	12·0	9·8	11·6
29	9·6		12·7	7·2	8·1	14·9	19·8	17·5	7·2	9·7	9·4	**12·5**
30	10·2		8·4	9·5	7·1	15·4	21·3	15·2	6·6	7·3	9·8	11·0
31	6·3		12·9		9·7		21·2	10·2		6·3		7·9
Monthly Mean .	9·7	9·4	11·5	9·7	9·2	15·1	**17·3**	14·8	8·9	9·0	**8·6**	9·5
Annual Variation	−1·4	−1·7	+0·4	−1·4	−1·9	+4·0	+6·2	+3·7	−2·2	−2·1	−2·5	−1·6

	Miles.
The Mean Velocity for June to August	15·7
The Mean Velocity for September to May	9·5
The Mean Velocity for the year	11·1
The greatest monthly mean (that of July)	17·3
The least monthly mean (that of November)	8·6
Difference = ...	8·7
The greatest Mean daily Velocity of Wind in the year (that of 16th June) was	30·7
The least do. do. do. (that of 7th February) was ...	5·2
Difference = ...	25·5

Aggregate and Mean Velocities and Relative Frequency of Different Winds, 1895.

TABLE IX.—*Showing, for the year 1895, the sums of the Velocities, and the Mean Velocities, in miles per hour, of the Winds which blew in each Month, from each of the sixteen Principal Directions: and also the number of hourly Observations which those sums comprise; the latter numbers indicating the Relative frequency of the same Wind (as to direction) in the several Months, and of different Winds during the same Month.*

1895.	N.			N.N.E.			N.E.			E.N.E.			E.			E.S.E.			S.E.			S.S.E.		
Month.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.
	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.
January ...	1,212	163	7·4	638	91	7·0	353	57	6·2	532	65	8·2	139	22	6·3	146	17	8·6	27	5	5·4	20	3	6·7
February ...	679	100	6·8	434	66	6·6	311	50	6·2	653	76	8·6	244	32	7·6	191	23	8·3	15	5	3·0	24	5	4·8
March ...	675	87	7·8	303	46	6·6	109	20	5·4	87	17	5·1	34	6	5·7	19	4	4·7	42	10	4·2	18	3	6·0
April ...	270	41	6·6	161	29	5·6	30	6	5·0	60	11	5·5	15	3	5·0	61	9	6·8	32	6	5·3	101	16	6·3
May ...	11	2	5·5	5	1	5·0	11	2	5·5	0	0	0·0	0	0	0·0	0	0	0·0	15	3	5·0	0	0	0·0
June... ...	111	23	4·8	79	12	6·6	74	9	8·2	73	6	12·2	71	6	11·8	27	4	6·7	42	4	10·5	847	31	27·3
July ...	0	0	0·0	0	0	0·0	0	0	0·0	0	0	0·0	14	1	14·0	13	1	13·0	21	2	10·5	537	33	16·3
August ...	0	0	0·0	0	0	0·0	0	0	0·0	0	0	0·0	6	1	6·0	0	0	0·0	23	4	5·7	14	2	7·0
September ...	149	24	6·2	54	11	4·9	53	10	5·3	80	19	4·2	104	12	8·7	206	31	6·6	236	29	8·1	198	23	8·6
October ...	347	54	6·4	117	16	7·3	476	61	7·8	1,442	140	10·3	576	52	11·1	420	48	8·7	189	26	7·3	197	19	10·4
November ...	463	74	6·3	223	38	5·9	431	64	6·7	1,354	147	9·2	927	105	8·8	230	33	7·0	9	2	4·5	63	3	21·0
December ...	560	79	7·1	249	34	7·3	649	86	7·5	2,060	209	9·9	560	58	9·7	238	24	9·9	58	9	6·4	9	2	4·5
Year ...	4,477	647	6·9	2,263	344	6·6	2,497	365	6·8	6,341	690	9·2	2,690	298	9·0	1,551	194	8·0	709	105	6·8	2,028	140	14·5

1895.	S.			S.S.W.			S.W.			W.S.W.			W.			W.N.W.			N.W.			N.N.W.			No. of Observations.		No. of hours.
Month.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Calm	Variable.	Record lost.
	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.			
January ...	13	3	4·3	14	2	7·0	10	2	5·0	47	6	7·8	155	19	8·2	571	59	9·7	1,734	134	12·9	1,623	95	17·1	1	0	0
February ...	4	1	4·0	3	1	3·0	0	0	0·0	27	5	5·4	186	21	8·9	717	73	9·8	1,763	139	12·7	1,064	75	14·2	0	0	0
March ...	125	11	11·4	81	13	6·2	17	2	8·5	129	14	9·2	143	21	6·8	1,201	94	12·8	3,878	262	14·8	1,705	133	12·8	1	0	0
April ...	166	15	11·1	279	36	7·7	84	14	6·0	508	56	9·1	970	115	8·4	1,756	146	12·0	1,831	149	12·3	680	68	10·0	0	0	0
May ...	34	2	17·0	415	32	13·0	173	29	6·0	831	111	7·5	2,967	326	9·1	1,647	163	10·1	575	59	9·7	150	13	11·5	1	0	0
June ...	1,544	53	29·1	1,313	71	18·5	1,071	71	15·1	2,754	175	15·7	540	45	12·0	1,526	122	12·5	619	70	8·8	170	18	9·4	0	0	0
July ...	805	44	18·3	670	50	13·4	519	48	10·8	7,125	379	18·8	3,124	184	17·0	0	0	0·0	10	1	10·0	0	0	0·0	0	1	0
August ...	53	6	8·8	59	10	5·9	672	59	11·4	6,067	373	16·3	3,784	261	14·5	306	24	12·7	39	4	9·7	0	0	0·0	0	0	0
September ...	236	33	7·2	168	26	6·5	160	27	5·9	483	53	9·1	599	54	11·1	1,558	138	11·3	1,587	160	9·9	506	68	7·4	2	0	0
October ...	258	29	8·9	189	20	9·4	42	9	4·7	73	14	5·2	259	39	6·6	516	60	8·6	1,011	98	10·3	613	59	10·4	0	0	0
November ...	5	1	5·0	0	0	0·0	3	1	3·0	25	4	6·2	127	16	7·9	541	64	8·5	1,108	108	10·3	667	59	11·3	1	0	0
December ...	0	0	0·0	9	2	4·5	0	0	0·0	17	2	8·5	99	13	7·6	603	66	9·1	851	80	10·6	1,133	80	14·2	0	0	0
Year ...	3,243	198	16·4	3,200	263	12·2	2,751	262	10·5	18,086	1,192	15·2	12,953	1,114	11·6	10,942	1,009	10·8	15,006	1,264	11·9	8,311	668	12·4	6	1	0

Temperature of the Ground, 1895.

TABLE X.—*Showing, for each Month, the Mean Temperature of the Ground, and its Annual Variation, at the respective depths of 1, 9, 20, 60 and 132 inches below the surface.*

DEPTH.	1 INCH.		9 INCHES.		20 INCHES.		60 INCHES.		132 INCHES.	
Month.	Mean Temperature.	Excess over the yearly Mean.	Mean Temperature.	Excess over the yearly Mean.	Mean Temperature.	Excess over the yearly Mean.	Mean Temperature.	Excess over the yearly Mean.	Mean Temperature.	Excess over the yearly Mean.
	°	°	°	°	°	°	°	°	°	°
January ...	75·5	—6·0	76·5	—5·1	79·7	—3·8	82·5	—1·7	82·6	—0·9
February ...	76·9	—4·6	76·8	—4·8	79·2	—4·3	81·6	—2·6	82·0	—1·5
March	81·2	—0·3	80·6	—1·0	81·9	—1·6	82·1	—2·1	82·0	—1·5
April	83·9	+2·4	83·0	+1·4	83·9	+0·4	83·3	—0·9	82·4	—1·1
May	86·3	+4·8	85·4	+3·8	86·2	+2·7	85·1	+0·9	83·2	—0·3
June	85·0	+3·5	85·3	+3·7	87·1	+3·6	86·6	+2·4	84·1	+0·6
July	82·5	+1·0	83·4	+1·8	85·7	+2·2	86·4	+2·2	84·7	+1·2
August... ...	81·5	0·0	82·2	+0·6	84·4	+0·9	85·4	+1·2	84·7	+1·2
September ...	81·2	—0·3	81·5	—0·1	83·7	+0·2	84·7	+0·5	84·5	+1·0
October ...	83·1	+1·6	82·8	+1·2	84·4	+0·9	84·5	+0·3	84·2	+0·7
November ...	82·7	+1·2	82·4	+0·8	84·2	+0·7	84·5	+0·3	83·9	+0·4
December ...	78·8	—2·7	79·2	—2·4	82·2	—1·3	84·0	—0·2	83·5	0·0
Year ...	81·5		81·6		83·5		84·2		83·5	

Extent of Cloudy Sky, 1895.

TABLE XI.—*Means of Estimations made at 6, 10, 14, 16 and 22 hours daily, the whole sky being reckoned as 10.*

1895.	MONTH.											
Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December
1		3·8	2·4	0·6	2·2	1·4	7·2	10·0	8·2	4·4	6·8	
2			4·6	0·4	2·0	2·2	5·4	7·6	7·8	6·4	7·8	5·0
3		0·8	0·6	1·2	2·4	3·6	6·6	8·4	6·8	5·2	7·4	1·2
4		0·6	2·2	2·8	2·8	2·0	8·4	10·0	9·6	1·4	5·8	
5			0·8	0·2	2·2	1·4	6·2	9·0	9·8	3·2	0·4	
6		3·8	0·2		1·6	2·0	8·2	10·0	10·0	1·8		
7	2·0	4·2	4·2	5·2	3·4	5·4	9·0	10·0	10·0	4·8	0·2	1·8
8	2·6	3·8	2·4	0·6	2·0	6·4	9·8	10·0	10·0	0·2		0·4
9	2·4	2·8	2·0		5·2	4·0	10·0	7·6	8·4	0·6		0·6
10	0·4	3·0	1·8		3·4	7·4	10·0	5·2	7·0	0·2		
11	1·6	0·6		1·2	6·6	7·0	9·2	7·2	8·8	0·4		
12	0·4				6·0	8·4	9·2	9·6	4·6	4·4		
13	1·2			0·4	4·2	6·2	7·2	9·4	7·4			
14	4·8				1·0	7·2	8·8	9·8	9·2	1·8	0·4	
15	1·8	1·4	3·4	0·2	2·2	9·6	8·2	9·2	10·0	0·8	0·2	
16		1·0	2·0	1·0	3·4	9·8	10·0	9·4	9·2	4·6	1·6	1·6
17		0·6	1·4		0·4	10·0	10·0	9·2	3·2	3·2		1·4
18					1·0	10·0	10·0	5·4	3·2	6·0		0·4
19		3·4		0·6	2·4	10·0	10·0	5·4	9·8	10·0	0·4	1·2
20	0·4	4·4		0·2	1·2	10·0	10·0	9·2	9·8	10·0	0·4	
21	0·8	0·6		1·4	2·0	8·6	5·8	10·0	7·0	10·0	2·0	3·2
22	1·8	2·0			1·4	6·8	7·6	6·8	8·4	8·2	0·2	3·8
23		6·2		0·2	6·6	8·0	8·8	7·4	5·2	7·6		6·4
24	0·2	0·8	3·6	1·4	4·0	10·0	5·6	8·8	7·6	9·6		7·8
25		0·2	1·6	0·8	3·2	10·0	9·0	8·2	5·8	4·8		5·4
26	0·8	2·2	0·2	1·0	5·8	7·8	8·0	10·0	8·2	6·0		0·8
27	0·6	1·2	0·2	0·8	0·8	8·4	10·0	8·4	8·0	1·6	2·2	
28		0·6	1·6	0·8	3·4	8·0	10·0	8·4	5·2	1·4	2·4	
29			2·4	3·4	3·2	9·0	10·0	8·8	5·2	0·6		1·0
30	1·4		2·8	1·6	4·6	9·0	10·0	9·8	6·4	7·6	0·2	0·4
31	3·4				1·4		10·0	8·0		2·0		4·0
Monthly Mean.	0·9	1·7	1·3	0·9	3·0	7·0	8·7	8·6	7·7	4·2	1·3	1·5
Annual Variation. ...	−3·0	−2·2	−2·6	−3·0	−0·9	+3·1	+4·8	+4·7	+3·8	+0·3	−2·6	−2·4

For the days which have no entry, 0·0 is to be understood.

Mean of the months from January to April, November and December ... ... 1·3

Mean of the months from May to October ... ... 6·5

Mean for the year ... ... 3·9

Rainfall, 1895.

TABLE XII.—*Total Fall of Rain (in inches) as measured by Newman's Gauge, placed 4½ feet above the ground.*

1895. Date.	MONTH. January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
		in.			in.	in.	in.	in.	in.	in.	in.	
1	...	...	...	...	...	...	0·25	0·10	0·08	...	0·01	...
2	...	...	...	...	...	...	...	0·07	0·03	...	**0·05**	...
3	...	...	...	...	...	...	...	0·25	0·02	...	...	...
4	...	...	...	...	...	...	...	0·39	0·01	...	...	...
5	...	...	...	...	...	...	0·09	0·52	0·05	...	...	...
6	...	...	...	...	...	...	0·18	1·38	0·02	...	...	...
7	...	...	...	...	...	...	0·06	**5·92**	**6·82**	...	...	...
8	...	...	...	...	...	...	0·31	3·01	1·10	0·04	...	...
9	...	...	...	...	...	...	0·26	0·19	0·09	...	...	...
10	...	...	...	...	...	0·14	**3·54**	0·12	0·41	...	...	...
11	...	...	...	...	...	0·04	1·41	0·03	0·22	...	...	...
12	...	...	...	...	...	0·28	0·11	0·03	...	...	...	...
13	...	...	...	...	...	1·00	0·33	...	...	...	...	...
14	...	...	...	...	...	1·08	0·83	0·23	0·58	...	...	...
15	...	...	...	...	...	2·00	0·11	0·23	0·51	...	...	...
16	...	...	...	...	...	1·45	0·72	0·11	0·69	...	...	...
17	...	...	...	...	...	1·17	1·11	...	...	...	...	...
18	...	...	...	...	00·1	1·26	3·04	0·24	...	...	...	...
19	...	...	...	...	..	1·93	2·01	0·01	0·30	0·44	...	...
20	...	0·07	...	...	...	**5·34**	0·37	0·02	0·02	0·81	...	...
21	...	...	...	...	...	1·32	0·23	0·33	0·02	0·10	...	...
22	...	...	...	...	...	0·11	0·07	0·38	0·52	...	...	...
23	...	...	...	...	...	0·24	0·01	0·29	...	0·25	...	...
24	...	...	...	...	...	0·30	0·07	0·46	...	**1·96**	...	...
25	...	...	...	...	...	0·09	0·41	0·37	0·03	0·02	...	...
26	...	...	...	...	...	0·02	0·08	...	0·38	...	...	...
27	...	...	...	...	...	0·05	0·28	0·22	...	...	...	...
28	...	...	...	...	**0·07**	0·01	0·45	0·17	0·01	...	...	...
29	...	...	...	...	...	...	1·42	0·02	...	...	...	...
30	...	...	...	...	...	0·01	0·21	0·62	...	...	...	...
31	...	...	...	...	...	...	0·08	0·26	...	...	...	...
Monthly Total	...	0·07	...	...	0·08	17·84	**18·04**	15·97	11·91	3·62	0·06	...
Number of rainy days	...	1		...	2	20	**28**	28	21	7	2	...

Total fall of rain in the year ... ... 67·59 inches.
Total number of rainy days in the year 109
The greatest daily fall of rain in the year (that of 7th September) was ... ... 6·82 inches.
No rain fell in the months of January, March, April and December nor on any of the days left blank in the above table.

Table XIII.—Five-day Means, 1895.

Number of Five-day Period.	Barometric Pressure.	Temperature of the Air.	Pressure of Vapour.	Additional Capacity of the Air.	*Rainfall.	North or South Component of Wind.	East or West Component of Wind.	Number of Five-day Period.	Barometric Pressure.	Temperature of the Air.	Pressure of Vapour.	Additional Capacity of the Air.	*Rainfall.	North or South Component of Wind.	East or West Component of Wind.
	In.	°	In.	In.	In.	Miles.	Miles.		In.	°	In.	In.	In.	Miles.	Miles.
1	29·932	74·2	0·581	0·269		5·1 N.	0·0	38	29·698	81·5	0·881	0·198	0·90	7·8 S.	9·9 W.
2	·929	74·4	·606	·250		5·7 N.	1·1 W.	39	·652	79·9	·901	·119	6·22	12·6 S.	3·3 W.
3	·913	73·2	·582	·240		7·0 N.	2·4 W.	40	·659	79·4	·875	·129	6·99	6·2 S.	17·3 W.
4	·924	72·4	·551	·253		9·5 N.	2·2 W.	41	·717	81·3	·890	·180	0·75	7·0 S.	15·4 W.
5	·967	70·8	·512	·247		7·9 N.	1·8 W.	42	·694	80·4	·877	·158	2·64	4·6 S.	19·7 W.
6	·922	73·7	·635	·201		6·0 N.	2·7 W.	43	·679	80·5	·885	·155	0·71	6·7 S.	16·8 W.
7	·906	72·0	·534	·260		8·4 N.	2·2 W.	44	·627	78·4	·864	·108	11·22	4·8 S.	17·9 W.
8	·876	71·5	·538	·240		4·8 N.	2·9 W.	45	·650	80·5	·885	·157	0·37	4·6 S.	16·3 W.
9	·959	72·8	·588	·225		5·9 N.	2·0 W.	46	·723	80·5	·875	·167	0·81	5·3 S.	12·6 W.
10	·925	75·1	·668	·210		5·8 N.	2·6 W.	47	·740	79·8	·854	·165	1·03	1·1 S.	9·9 W.
11	·957	80·0	·668	·362	0·07	4·4 N.	2·5 E.	48	·734	79·8	·845	·174	1·22	0·6 S.	11·3 W.
12	·933	77·3	·677	·266		5·4 N.	3·7 W.	49	·791	79·7	·826	·189	1·01	2·1 S.	11·6 W.
13	·887	79·0	·708	·287		8·5 N.	4·8 W.	50	·767	78·1	·813	·150	6·92	2·5 N.	9·1 W.
14	·836	79·4	·786	·221		1·5 N.	3·9 W.	51	·818	78·4	·852	·122	1·82	2·1 S.	4·6 W.
15	·799	79·3	·741	·263		9·3 N.	6·8 W.	52	·773	78·7	·836	·148	1·78	0·3 N.	2·3 W.
16	·829	79·1	·700	·299		8·2 N.	5·6 W.	53	·827	80·3	·877	·159	0·86	3·4 N.	3·3 W.
17	·831	78·9	·740	·251		7·4 N.	6·9 W.	54	·837	80·0	·846	·181	0·41	5·5 N.	3·8 W.
18	·836	79·9	·762	·264		10·1 N.	7·7 W.	55	·780	82·0	·929	·169	0·01	1·5 S.	0·4 W.
19	·836	80·0	·752	·277		10·0 N.	7·2 W.	56	·858	80·9	·850	·209		4·6 N.	2·6 W.
20	·785	81·2	·802	·267		0·0 N.	4·6 W.	57	·861	82·5	·809	·311	0·04	4·0 N	1·8 E.
21	·830	81·3	·823	·250		0·8 S.	4·9 W.	58	·795	82·9	·841	·292		2·5 N.	1·6 E.
22	·810	83·5	·871	·280		4·0 N.	6·4 W.	59	·815	79·6	·846	·172	1·35	1·1 N.	4·5 E.
23	·753	82·8	·858	·266		4·3 N.	7·1 W.	60	·796	80·6	·830	·218	2·23	1·7 N.	2·2 E.
24	·804	82·7	·803	·317		1·2 N.	7·4 W.	61	·806	81·4	·779	·298	0·01	3·8 N.	0·9 E.
25	·819	82·9	·849	·278		4·5 N.	8·7 W.	62	·922	81·2	·870	·200	0·05	3·6 N.	0·7 E.
26	·790	82·9	·854	·274		1·1 N.	6·7 W.	63	·925	81·3	·814	·259		4·3 N.	0·1 W.
27	·743	84·7	·913	·281		3·6 S.	7·3 W.	64	·968	80·6	·754	·297		4·1 N.	0·6 E.
28	·790	84·3	·802	·379	0·01	1·4 N.	9·9 W.	65	·946	80·7	·734	·321		3·8 N.	0·9 E.
29	·798	84·8	·873	·326		1·0 S.	7·8 W.	66	·923	80·5	·666	·383		4·3 N.	4·7 E.
30	·814	84·9	·871	·330	0·07	0·2 S.	7·9 W.	67	·931	78·6	·645	·341		5·0 N.	2·9 E.
31	·767	85·4	·896	·327		3·7 N.	8·4 W.	68	·895	76·9	·645	·285		5·8 N.	0·5 E.
32	·740	86·4	·947	·313		5·2 N.	7·7 W.	69	·873	76·3	·592	·319		4·1 N.	1·2 E.
33	·637	83·3	·924	·220	2·54	2·5 S.	2·4 W.	70	·943	74·9	·518	·357		5·4 N.	3·0 E.
34	·504	79·7	·922	·094	7·81	19·4 S.	0·5 W.	71	·980	77·0	·659	·275		4·1 N.	1·4 E.
35	·630	81·1	·910	·155	7·31	11·8 S.	12·2 W.	72	·987	76·0	·564	·340		6·0 N.	3·7 E.
36	·673	82·9	·930	·197	0·17	6·5 S.	14·6 W.	73	·935	76·8	·589	·341		5·1 N.	2·8 E.
37	·720	83·6	·919	·231	0·26	2·1 S.	13·5 W.								

* Five-day sums, *not means*.

Meteorological Elements, 1891 to 1895.

TABLE XIV.—*Annual and Lustral Means.*

Year.	Barometric Pressure.	Temperature of Air.	Pressure of Vapour.	Additional Capacity.	*Rainfall.	Wind.	
						North Component.	East Component.
	In.	°	In.	In.	In.	Miles.	Miles.
1891	29·834	79·5	0·757	0·260	77·18	3·0 N.	5·5 W.
1892	·790	79·9	·792	·239	95·12	0·4 N.	4·6 W.
1893	·815	78·9	·759	·238	67·24	1·9 N.	5·3 W.
1894	·809	79·6	·784	·233	66·85	1·6 N.	5·5 W.
1895	·819	79·6	·776	·243	67·59	1·7 N.	4·9 W.
Mean	29·813	79·5	0·774	0·243	74·80	1·7 N.	5·2 W.

* Sums, *not* means.

TABLES OF RESULTS

OF

ABSOLUTE MAGNETICAL OBSERVATIONS,

1895.

R 590—1

Absolute Magnetical Observations.—Table I.

Observations of Vibration and Deflection, taken with the Kew Unifilar Magnetometer (No. 23, by Elliott Brothers), for the determination of Absolute Horizontal Force.

1895.

1895. Date.	Civil Time, Mean.	Magnet N. 23 *a*. Time of one Vibration.	Effect of 90° Torsion.	Temperature.	Rate of Chronometer.	Corresponding Mean Reading of L. H. F. Magnetometer. Scale Reading.	Thermometer.	Angle of Deflection of Magnet N. 23 *c* by N. 23 *a* at Distance. 0·8 foot.	1·0 foot.	Temperature.	Corresponding Mean Reading of L. H. F. Magnetometer. Scale Reading.	Thermometer.	Observer.	Calculated Results in English Units. Values of m.	Values of X. From Deflections at distance. 0·8 foot ($X_{0\cdot8}$)	1·0 foot ($X_{1\cdot0}$)	Difference. $X_{0\cdot8} - X_{1\cdot0}$	Mean. $\frac{X_{0\cdot8}+X_{1\cdot0}}{2}$	Monthly Mean Values of X.	Monthly Mean Values of X in Metrical Units.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
	h. m.	s.	Sc. div.	°	s.		°	° ′ ″	° ′ ″	°		°								
JANUARY 2	12 22	2·8445	0·42	83·1	−10·5	15·53	78·6	27 27 37	8 52 36	82·1	15·34	79·1	V.G.G.	·63574	8·1111	8·1094	+·0017	8·1102		
,, ,,	15 29	2·8446	0·43	81·8	,,	15·03	80·2	17 28 26	8 53 5	82·9	15·06	79·9	V.G.G.	·63599	8·1061	8·1036	+·0025	8·1048		
,, 9	12 23	2·8418	0·48	84·9	− 7·2	16·66	80·9	17 26 0	8 51 47	84·5	16·39	81·1	D.	·63612	8·1246	8·1229	+·0017	8·1237		
,, ,,	15 26	2·8436	0·49	81·8	,,	14·92	82·0	17 26 47	8 52 7	84·8	15·63	81·5	D.	·63617	8·1133	8·1122	+·0011	8·1127		
,, 16	12 10	2·8416	0·48	79·6	− 8·1	17·15	76·7	17 26 29	8 51 56	79·6	17·02	77·4	N.	·63567	8·1231	8·1221	+·0010	8·1226		
,, ,,	15 21	2·8427	0·47	80·7	,,	16·36	79·1	17 26 45	8 52 5	80·4	16·56	78·6	N.	·63570	8·1191	8·1180	+·0011	8·1185	8·1161	3·7422
,, 23	12 30	2·8418	0·52	78·4	− 7·5	17·16	74·2	17 27 2	8 52 15	78·7	17·05	74·9	D.	·63567	8·1203	8·1190	+·0013	8·1196		
,, ,,	15 36	2·8431	0·53	79·0	,,	16·34	76·9	17 27 32	8 52 32	79·9	16·70	75·8	D.	·63576	8·1141	8·1126	+·0015	8·1133		
,, 30	12 17	2·8425	0·56	81·2	− 9·6	16·92	78·7	17 26 15	8 51 52	81·5	16·73	79·3	V.G.G.	·63558	8·1208	8·1195	+·0013	8·1201		
,, ,,	15 21	2·8434	0·53	80·7	,,	15·94	80·3	17 26 25	8 51 57	82·2	16·29	80·1	V.G.G.	·63567	8·1165	8·1152	+·0013	8·1158		
FEBRUARY 6	12 16	2·8428	0·56	78·7	− 7·6	16·86	75·5	17 27 7	8 52 22	78·8	16·94	76·2	D.	·63559	8·1171	8·1152	+·0019	8·1161		
,, ,,	15 28	2·8437	0·53	78·8	,,	16·11	77·9	17 26 57	8 52 16	79·8	16·59	77·2	D.	·63552	8·1145	8·1128	+·0017	8·1136		
,, 13	12 16	2·8422	0·58	80·4	− 8·2	17·35	76·6	17 26 30	8 52 1	80·0	17·09	77·1	V.G.G.	·63556	8·1216	8·1201	+·0015	8·1208		
,, ,,	15 17	2·8441	0·58	80·9	,,	15·80	79·2	17 26 44	8 52 7	81·2	16·61	78·5	V.G.G.	·63574	8·1147	8·1132	+·0015	8·1139	8·1198	3·7439
,, 20	12 16	2·8435	0·59	85·1	− 8·0	16·31	81·2	17 24 27	8 51 0	86·5	16·12	84·9	V.G.G.	·63549	8·1234	8·1219	+·0015	8·1226		
,, ,,	15 21	2·8444	0·56	88·8	,,	15·53	83·1	17 24 35	8 51 5	88·4	15·64	82·4	V.G.G.	·63574	8·1218	8·1203	+·0015	8·1210		
,, 27	12 2	2·8420	0·56	86·1	−10·7	16·76	82·0	17 24 0	8 50 45	85·9	16·65	82·5	N.	·63571	8·1307	8·1294	+·0013	8·1300		
,, ,,	15 25	2·8436	0·59	83·5	,,	15·84	83·7	17 24 37	8 51 2	86·2	16·06	83·1	N.	·63545	8·1212	8·1201	+·0011	8·1206		
MARCH 6	13 13	2·8435	0·67	87·8	− 9·9	16·04	84·2	17 24 25	8 50 57	88·2	15·94	84·5	D.	·63576	8·1242	8·1229	+·0013	8·1235		
,, ,,	15 34	2·8457	0·63	88·1	,,	14·58	86·1	17 24 40	8 51 6	88·7	15·50	85·3	D.	·63581	8·1167	8·1152	+·0015	8·1159		
,, 13	12 12	2·8431	0·59	88·0	− 8·8	16·30	83·6	17 24 15	8 50 50	87·4	16·05	84·3	N.	·63571	8·1270	8·1259	+·0011	8·1264		
,, ,,	15 28	2·8458	0·56	87·0	,,	14·46	85·9	17 24 50	8 51 11	87·6	15·20	85·6	N.	·63567	8·1161	8·1147	+·0014	8·1154	8·1186	3·7433
,, 20	12 3	2·8436	0·53	85·9	− 7·9	16·07	82·2	17 25 20	8 51 27	86·1	15·82	83·0	D.	·63573	8·1210	8·1193	+·0017	8·1201		
,, ,,	15 49	2·8454	0·54	85·2	,,	14·89	84·8	17 25 57	8 51 47	86·7	15·10	84·2	D.	·63565	8·1124	8·1107	+·0017	8·1115		
,, 27	12 5	2·8432	0·55	83·9	− 7·2	16·25	82·6	17 24 53	8 51 12	85·1	16·08	83·0	N.	·63549	8·1231	8·1218	+·0013	8·1224		
,, ,,	15 21	2·8448	0·58	83·6	,,	15·12	83·4	17 25 50	8 51 40	85·5	15·54	83·2	N.	·63567	8·1143	8·1130	+·0013	8·1136		

1895. Date.	Civil Time, Mean.	Magnet N. 23 *a*. Time of one Vibration.	Effect of 90° Torsion.	Temperature.	Rate of Chronometer.	Corresponding Mean Reading of L. H. F. Magnetometer. Scale Reading.	Thermometer.	Angle of Deflection of Magnet N. 23 *c* by N. 23 *a* at Distance. 0·8 foot.	1·0 foot.	Temperature.	Corresponding Mean Reading of L. H. F. Magnetometer. Scale Reading.	Thermometer.	Observer.	Calculated Results in English Units. Values of m.	Values of X. From Deflections at distance. 0·8 foot ($X_{0\cdot8}$)	1·0 foot ($X_{1\cdot0}$)	Difference. $X_{0\cdot8}-X_{1\cdot0}$	Mean. $\frac{X_{0\cdot8}+X_{1\cdot0}}{2}$	Monthly Mean Values of X.	Monthly Mean Values of X in Metrical Units.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
	h. m.	s.	Sc. div.	°	s.		°	° ′ ″	° ′ ″	°		°								
April 4	12 15	2·8437	0·54	86·7	−8·1	15·99	84·4	17 25 32	8 51 30	85·9	15·50	85·2	D.	·63568	8·1208	8·1197	+·0011	8·1202		
„ „	15 16	2·8446	0·55	87·0	„	15·44	85·0	17 25 44	8 51 35	86·7	15·45	85·0	D.	·63580	8·1171	8·1160	+·0011	8·1165		
„ 10	12 5	2·8435	0·56	88·4	−8 9	15·82	85·0	17 23 2	8 50 15	88·7	15·83	85·3	V. G. G.	·63549	8·1296	8·1285	+·0011	8·1290		
„ „	15 10	2·8447	0·59	89·0	„	15·01	86·2	17 23 55	8 50 40	89·8	15·27	85·8	V. G. G.	·63565	8·1221	8·1212	+·0009	8·1216		
„ 17	12 1	2·8440	0·57	89·2	−8·9	15·31	85·4	17 24 52	8 51 6	88·9	14·79	85·8	D.	·63571	8·1218	8·1210	+·0008	8·1214	8·1206	3·7442
„ „	15 34	2·8449	0·59	87·0	„	14·54	87·0	17 25 45	8 51 35	88·9	14·55	86·5	D.	·63583	8·1139	8·1128	+·0011	8·1133		
„ 24	12 2	2·8441	0·55	90·2	−9·0	15·59	86·6	17 23 2	8 50 12	91·0	15·51	87·0	N.	·63561	8·1274	8·1266	+·0008	8·1270		
„ „	15 39	2·8454	0·57	88·7	„	14·37	88·0	17 24 35	8 50 57	91·1	14·77	87·7	N.	·63584	8·1163	8·1158	+·0005	8·1160		
May 1	12 19	2·8430	0·58	88·5	−8·1	16·04	86·6	17 23 19	8 50 22	88·9	15·81	87·0	D.	·63559	8·1300	8·1289	+·0011	8·1294		
„ „	15 35	2·8442	0·57	88·5	„	14·75	87·7	17 24 10	8 50 52	89·2	15·22	87·7	D.	·63595	8·1231	8·1216	+·0015	8·1223		
„ 8	12 10	2·8442	0·62	91·0	−7·9	15·33	86·9	17 23 32	8 50 28	91·4	15·24	87·3	N.	·63580	8·1255	8·1246	+·0009	8·1250		
„ „	15 17	2·8447	0·58	90·4	„	14·63	88·1	17 23 55	8 50 42	92·1	14·74	87·9	N.	·63589	8·1214	8·1203	+·0011	8·1208		
„ 15	12 13	2·8451	0·58	92·6	−8·5	14·84	87·9	17 23 25	8 50 25	92·1	14·87	88·1	D.	·63577	8·1240	8·1231	+·0009	8·1235		
„ „	15 43	2·8458	0·65	91·0	„	14·13	89·3	17 23 50	8 50 37	92·8	14·37	88·9	D.	·63574	8·1184	8·1175	+·0009	8·1179	8·1228	3·7453
„ 22	12 4	2·8447	0·58	92·5	−8·1	15·40	89·0	17 21 55	8 49 36	92·8	15·31	89·3	N.	·63539	8·1300	8·1296	+·0004	8·1298		
„ „	15 17	2·8462	0·62	92·0	„	14·13	90·1	17 23 2	8 50 7	93·6	14·69	90·0	N.	·63568	8·1203	8·1203	·0000	8·1203		
„ 29	12 2	2·8449	0·62	93·1	−8·3	15·36	88·1	17 23 27	8 50 22	93·4	14·64	88·4	D.	·63556	8·1236	8·1231	+·0005	8·1233		
„ „	15 44	2·8463	0·59	92·0	„	14·15	89·3	17 23 50	8 50 35	94·6	14·11	89·0	D.	·63568	8·1163	8·1156	+·0007	8·1159		
June 5	12 1	2·8456	0·58	90·7	−9·3	14·77	89·8	17 23 3	8 50 16	92·2	14·62	89·9	N.	·63533	8·1221	8·1210	+·0011	8·1215		
„ „	15 22	2·8465	0·61	91·2	„	14·13	90·8	17 23 15	8 50 27	93·2	14·36	90·6	N.	·63549	8·1184	8·1165	+·0019	8·1174		
„ 12	12 15	2·8440	0·64	88·0	−9·5	15·54	86·0	17 23 0	8 50 17	89·1	15·52	86·1	D.	·63535	8·1274	8·1259	+·0015	8·1266		
„ „	15 35	2·8462	0·63	90·5	„	14·63	87·1	17 23 11	8 50 25	90·9	15·09	86·8	D.	·63542	8·1208	8·1190	+·0018	8·1199		
„ 19	12 12	2·8433	0·58	82·8	−10·7	16·35	82·0	17 25 10	8 51 22	82·5	16·08	81·9	V. G. G.	·63518	8·1229	8·1214	+·0015	8·1221	8·1217	3·7448
„ „	15 28	2·8445	0·59	82·2	„	15·25	81·8	17 25 35	8 51 32	82·4	15·58	81·7	V. G. G.	·63526	8·1173	8·1161	+·0012	8·1167		
„ 26	12 11	2·8443	0·58	88·6	−10·3	16·18	85·0	17 22 16	8 49 57	89·0	16·00	85·2	D.	·63502	8·1300	8·1281	+·0019	8·1290		
„ „	15 33	2·8464	0·62	88·5	„	14·97	86·0	17 22 42	8 50 10	89·7	15·45	85·7	D.	·63501	8·1214	8·1197	+·0017	8·1205		
July 3	12 4	2·8451	0·58	90·0	−10·7	15·36	86·6	17 22 45	8 50 11	90·1	15·24	86·9	N.	·63520	8·1259	8·1242	+·0017	8·1250		
„ „	15 22	2·8462	0·53	90·0	„	14·55	87·4	17 23 15	8 50 27	91·1	14·86	87·2	N.	·63536	8·1201	8·1182	+·0019	8·1191		
„ 10	12 24	2·8435	0·59	85·7	−9·8	16·10	83·5	17 23 57	8 50 46	85·8	15·84	83·7	D.	·63523	8·1262	8·1247	+·0015	8·1254		
„ „	15 38	2·8460	0·60	84·9	„	15·12	83·9	17 25 7	8 51 15	85·5	15·32	83·9	D.	·63514	8·1145	8·1135	+·0010	8·1140		
„ 17	12 8	2·8450	0·52	84·0	−10·2	15·71	82·6	17 24 57	8 51 7	83·6	15·60	82·6	N.	·63495	8·1190	8·1184	+·0006	8·1187	8·1206	3·7442
„ „	15 18	2·8458	0·58	83·0	„	15·30	82·6	17 25 40	8 51 32	83·5	15·36	82·6	N.	·63501	8·1132	8·1122	+·0010	8·1127		
„ 24	12 12	2·8443	0·58	85·9	−10·4	15·67	84·0	17 23 27	8 50 18	87·0	15·57	84·2	D.	·63501	8·1247	8·1249	−·0002	8·1248		
„ „	15 35	2·8455	0·59	86·4	„	15·07	85·0	17 23 36	8 50 22	87·6	15·34	84·8	D.	·63502	8·1206	8·1208	−·0002	8·1207		
„ 31	12 1	2·8439	0·59	84·9	−11·3	15·97	83·0	17 23 53	8 50 29	84·5	15·86	83·1	N.	·63497	8·1259	8·1262	−·0003	8·1260		
„ „	15 35	2·8449	0·61	83·5	„	15·45	83·0	17 24 31	8 50 52	84·0	15·58	83·1	N.	·63494	8·1197	8·1195	+·0002	8·1196		

August	7	12	1	2·8431	0·62	80·5	—11·3	16·27	80·6	17	25	7	8	51	12	81·6	16·17	80·5	D.	·63502	8·1225	8·1219	+·0006	8·1222			
	„	15	30	2·8448	0·57	81·0	„	15·45	81·0	17	25	25	8	51	21	82·0	15·80	81·0	D.	·63502	8·1165	8·1160	+·0005	8·1162			
	„	14	12	3	2·8449	0·57	86·4	—11·6	15·28	83·5	17	24	20	8	50	52	86·4	15·27	83·7	N.	·63521	8·1208	8·1199	+·0009	8·1203			
	„	„	15	23	2·8453	0·61	85·0	„	14·92	83·5	17	24	55	8	51	7	85·7	15·11	83·7	N.	·63524	8·1169	8·1161	+·0008	8·1165	8·1215	3·7447	
	„	21	11	59	2·8437	0·62	85·4	—12·1	15·93	82·2	17	23	42	8	50	39	84·7	15·84	82·3	D.	·63508	8·1272	8·1255	+·0017	8·1263			
	„	„	15	24	2·8449	0·60	84·8	„	15·18	82·9	17	23	57	8	50	44	86·1	15·43	82·7	D.	·63508	8·1210	8·1195	+·0015	8·1202			
	„	28	12	12	2·8437	0·54	85·1	—12·1	15·74	82·8	17	23	11	8	50	23	86·3	15·81	83·3	N.	·63514	8·1276	8·1261	+·0015	8·1268			
	„	„	15	29	2·8444	0·58	86·1	„	15·28	84·0	17	23	32	8	50	36	86·5	15·54	84·0	N.	·63523	8·1249	8·1229	+·0020	8·1239			
Sept.	4	13	19	2·8447	0·60	84·9	—13·0	15·35	82·3	17	27	0	8	52	12	83·3	14·62	82·5	D.	·63535	8·1126	8·1117	+·0009	8·1121			
	„	„	15	39	2·8463	0·59	81·2	„	14·15	82·1	17	27	35	8	52	27	82·4	14·31	82·4	D.	·63530	8·1038	8·1031	+·0007	8·1034			
	„	11	12	4	2·8431	0·55	86·0	—12·9	16·33	82·4	17	23	10	8	50	15	85·5	16·23	82·8	N.	·63513	8·1307	8·1302	+·0005	8·1304			
	„	„	15	12	2·8446	0·54	84·3	„	15·25	83·0	17	24	25	8	50	55	85·9	15·57	83·0	N.	·63529	8·1199	8·1190	+·0009	8·1194	8·1187	3·7434	
	„	18	12	30	2·8443	0·55	86·8	—14·1	15·60	82·9	17	23	45	8	50	39	86·8	15·50	83·6	D.	·63523	8·1244	8·1229	+·0015	8·1236			
	„	„	15	36	2·8451	0·58	86·0	„	15·05	84·0	17	23	50	8	50	40	87·1	15·33	83·9	D.	·63517	8·1208	8·1195	+·0013	8·1201			
	„	25	12	7	2·8442	0·54	86·0	—14·0	15·60	82·9	17	23	57	8	50	43	85·6	15·48	83·3	N.	·63513	8·1244	8·1233	+·0011	8·1238			
	„	„	15	25	2·8453	0·57	84·7	„	14·81	83·7	17	24	45	8	51	8	85·5	15·05	83·6	N.	·63517	8·1173	8·1158	+·0015	8·1165			
Oct.	2	12	7	2·8449	0·57	88·3	—14·1	14·92	85·3	17	23	49	8	50	35	89·8	14·37	86·0	D.	·63517	8·1210	8.1203	+·0007	8·1206			
	„	„	15	35	2·8456	0·57	88·8	„	14·00	87·0	17	24	40	8	50	56	90·6	14·05	86·9	D.	·63559	8·1156	8·1154	+·0002	8·1155			
	„	9	12	10	2·8448	0·55	90·0	—13·6	15·14	86·0	17	23	0	8	50	6	90·1	14·90	86·2	N.	·63520	8·1257	8·1257	·0000	8·1257			
	„	„	15	20	2·8456	0·57	90·2	„	14·10	87·8	17	23	45	8	50	33	91·0	14·36	87·2	N.	·63554	8·1199	8·1191	+·0008	8·1195			
	„	16	12	13	2·8449	0·58	91·0	—13·9	14·92	87·1	17	22	50	8	50	5	90·6	14·75	87·5	V. G. G.	·63529	8·1262	8·1257	+·0005	8·1259	8·1218	3·7448	
	„	„	15	22	2·8455	0·58	89·9	„	14·09	88·6	17	23	55	8	50	35	91·0	14·13	88·3	V. G. G.	·63546	8·1191	8·1190	+·0001	8·1190			
	„	23	12	11	2·8434	0·57	88·6	—13·6	15·73	85·0	17	22	52	8	50	6	88·5	15·50	85·3	N.	·63529	8·1306	8·1298	+·0008	8·1302			
	„	„	15	31	2·8445	0·58	87·8	„	14·87	86·0	17	23	22	8	50	22	89·0	15·08	85·9	N.	·63536	8·1242	8·1234	+·0008	8·1238			
	„	30	12	11	2·8448	0·61	89·8	—14·3	14·87	85·7	17	23	45	8	50	32	89·8	14·74	86·0	V. G. G.	·63546	8·1229	8·1223	+·0006	8·1226			
	„	„	15	20	2·8458	0·59	88·4	„	14·18	86·7	17	24	22	8	50	52	90·5	14·37	86·5	V. G. G.	·63551	8·1158	8·1150	+·0008	8·1154			
Nov.	6	12	6	2·8439	0·63	89·9	—14·6	15·45	86·2	17	22	43	8	50	4	89·7	15·29	86·7	N.	·63536	8·1294	8·1285	+·0009	8·1289			
	„	„	15	35	2·8450	0·59	88·1	„	14·60	87·2	17	23	19	8	50	22	89·5	14·88	87·0	N.	·63532	8·1227	8·1218	+·0009	8·1222			
	„	13	12	11	2·8456	0·60	90·8	—13·4	14·83	85·5	17	23	35	8	50	27	89·5	14·79	86·0	D.	·63535	8·1225	8·1218	+·0007	8·1221			
	„	„	15	32	2·8460	0·54	87·8	„	14·11	87·3	17	24	10	8	50	46	89·7	14·50	86·8	D.	·63539	8·1163	8·1158	+·0005	8·1160	8·1242	3·7459	
	„	20	12	8	2·8446	0·56	90·0	—13·1	15·79	85·7	17	22	27	8	49	55	89·3	15·51	86·0	V. G. G.	·63504	8·1291	8·1283	+·0008	8·1287			
	„	„	15	19	2·8454	0·57	89·9	„	14·83	87·5	17	22	57	8	50	7	90·9	15·03	86·9	V. G. G.	·63527	8·1234	8·1231	+·0003	8·1232			
	„	27	12	13	2·8438	0·59	88·1	—12·3	16·10	84·2	17	22	34	8	49	56	87·9	15·80	84·9	D.	·63504	8·1306	8·1300	+·0006	8·1303			
	„	„	15	21	2·8456	0·57	87·4	„	14·97	87·0	17	22	50	8	50	7	89·7	15·41	85·9	D.	·63504	8·1223	8·1216	+·0007	8·1219			
Dec.	4	12	22	2·8435	0·57	85·6	—12·1	16·38	82·2	17	22	57	8	50	12	86·4	16·07	82·9	V. G. G.	·63497	8·1292	8·1283	+·0009	8·1287			
	„	„	15	11	2·8446	0·56	86·5	„	15·57	84·3	17	23	12	8	50	17	87·1	15·77	83·8	V. G. G.	·63505	8·1253	8·1246	+·0007	8·1249			
	„	11	11	59	2·8451	0·57	84·6	—11·6	15·75	80·4	17	24	2	8	50	47	84·6	15·65	80·9	D.	·63483	8·1214	8·1199	+·0015	8·1206			
	„	„	15	23	2·8447	0·61	83·0	„	15·54	82·2	17	23	47	8	50	42	85·4	15·56	81·6	D.	·63478	8·1214	8·1195	+·0019	8·1204			
	„	18	12	8	2·8434	0·59	86·2	—13·5	16·43	81·4	17	22	50	8	50	16	86·1	16·33	81·9	N.	·63508	8·1306	8·1285	+·0021	8·1295	8·1242	3·7459	
	„	„	15	26	2·8439	0·58	85·5	„	15·77	83·8	17	23	1	8	50	20	86·9	15·88	83·3	N.	·63504	8·1274	8·1255	+·0019	8·1264			
	„	25	12	31	2·8439	0·61	83·9	—12·3	16·07	80·2	17	23	57	8	50	50	84·6	16·12	80·7	V. G. G.	·63499	8·1246	8·1225	+·0021	8·1235			
	„	„	15	24	2·8447	0·61	84·3	„	15·46	81·5	17	24	7	8	50	55	85·5	15·75	81·1	V. G. G.	·63514	8·1210	8·1190	+·0020	8·1200			

The mean value of the Horizontal Force for the year 1895 = 8·1209 | 3·7444

Absolute Magnetical Observations.—Table II.

Observations of Absolute Declination.

1895.

1895. Date.	Bombay Civil Time.	Mean Readings. Collimator Magnet. Scale apparently Erect.	Mean Readings. Collimator Magnet. Scale apparently Inverted.	Mean Readings. Horizontal Circle with Telescope pointed to Scale of Collimator Magnet.	Mean Readings. Horizontal Circle with Telescope pointed to Tárdeo Chimney.	Torsion. Mean.	Torsion. Effect of 90.'	Observer.	Corresponding Reading of large Declination Magnetometer.	Absolute Easterly Declination corrected for Torsion.	Monthly Mean. Corresponding Reading of large Declination Magnetometer.	Monthly Mean. Absolute Easterly Declination.
1	2	3	4	5	6	7	8	9	10	11	12	13
	h. m.	Sc. div.	Sc. div.	° ′ ″	° ′ ″	°	Sc. div.		Sc. div.	° ′ ″	Sc. div.	° ′ ″
JAN. 3	11 34	+1·60	+1·54	17 3 25	196 52 10	0		N.	33·99	0 37 45		
,, 10	11 30	+1·52	+1·69	17 4 5	196 51 40	0		D.	34·15	0 38 40		
,, 17	11 34	+1·52	+1·70	17 3 30	196 52 15	0		N.	33·96	0 37 29	34·05	0 38 4
,, 24	11 30	+1·51	+1·64	17 4 55	196 51 50	0		D.	34·25	0 39 23		
,, 31	11 21	+1·49	+1·66	17 2 50	196 52 0	0		V.G.G.	33·90	0 37 5		
FEB. 7	11 27	+1·57	+1·64	17 4 17	196 52 20	5 W	0·74	D.	34·13	0 38 25		
,, 14	11 34	+1·54	+1·55	17 3 0	196 52 25	0		V.G.G.	33·90	0 37 1	34·06	0 38 8
,, 21	11 48	+1·49	+1·72	17 3 15	196 51 40	0		V.G.G.	34·00	0 37 46		
,, 28	11 31	+1·51	+1·61	17 5 30	196 52 30	0		N.	34·22	0 39 19		
MARCH 7	11 30	+1·52	+1·72	17 2 40	196 51 55	0		D.	33·89	0 36 57		
,, 14	11 53	+1·51	+1·65	17 1 55	196 52 0	0		N.	33·76	0 36 11	33·89	0 37 3
,, 21	11 17	+1·49	+1·71	17 3 22	196 52 12	0		D.	33·94	0 37 21		
,, 28	11 42	+1·51	+1·65	17 3 32	196 52 5	0		N.	33·99	0 37 43		
APRIL 5	11 36	+1·54	+1·65	17 2 12	196 51 55	0		D.	33·80	0 36 36		
,, 11	11 25	+1·51	+1·55	17 2 20	196 51 42	0		V.G.G.	33·87	0 37 1		
,, 18	11 27	+1·51	+1·71	17 1 50	196 51 50	0		D.	33·76	0 36 12	33·79	0 36 26
,, 25	11 40	+1·52	+1·61	17 1 50	196 52 15	0		N.	33·72	0 35 55		
MAY 2	11 28	+1·52	+1·56	17 0 25	196 51 20	10 E	0·61	D.	33·64	0 35 19		
,, 9	11 29	+1·52	+1·62	17 0 5	196 51 25	0		N.	33·59	0 34 59		
,, 16	11 27	+1·54	+1·62	17 0 45	196 51 35	0		D.	33·66	0 35 30	33·63	0 35 18
,, 23	11 33	+1·52	+1·61	17 0 42	196 52 15	0		N.	33·55	0 34 47		
,, 30	11 16	+1·51	+1·61	17 1 0	196 51 25	0		D.	33·71	0 35 54		
JUNE 6	11 33	+1·55	+1·52	17 0 0	196 51 30	0		N.	33·56	0 34 57		
,, 13	11 28	+1·47	+1·71	17 1 25	196 52 0	0		D.	33·64	0 35 34		
,, 20	11 40	+1·50	+1·71	17 2 10	196 52 25	0		N.	33·69	0 35 57	33·62	0 35 30
,, 27	11 25	+1·50	+1·71	17 3 10	196 53 50	0		D.	33·61	0 35 32		
JULY 4	11 34	+1·56	+1·59	17 4 35	196 54 0	0		N.	33·81	0 37 0		
,, 11	11 32	+1·50	+1·66	17 4 40	196 54 35	0		D.	33·73	0 36 20		
,, 18	11 29	+1·50	+1·57	17 3 40	196 55 2	0		N.	33·54	0 35 0	33·63	0 35 40
,, 25	11 18	+1·60	+1·54	17 2 42	196 55 0	10 W	0·61	D.	33·46	0 34 21		
AUG. 1	11 32	+1·50	+1·55	17 5 2	196 54 47	0		N.	33·82	0 36 38		
,, 8	11 31	+1·46	+1·71	17 4 5	196 54 45	0		D.	33·64	0 35 29		
,, 15	11 28	+1·51	+1·65	17 3 30	196 54 50	0		N.	33·55	0 34 56	33·56	0 34 55
,, 22	11 30	+1·54	+1·61	17 1 42	196 54 12	0		D.	33·41	0 33 52		
,, 29	11 34	+1·52	+1·64	17 1 20	196 54 0	0		N.	33·36	0 33 38		
SEPT. 5	11 27	+1·51	+1·61	17 2 35	196 53 50	10 W	0·65	D.	33·58	0 35 14		
,, 12	11 31	+1·52	+1·61	17 2 0	196 53 52	0		N.	33·45	0 34 28	33·50	0 34 50
,, 19	11 28	+1·51	+1·65	17 2 40	196 54 2	0		D.	33·50	0 34 54		
,, 26	11 36	+1·54	+1·59	17 2 30	196 54 10	0		N.	33·48	0 34 43		
OCT. 3	11 32	+1·49	+1·61	17 0 47	196 53 55	0		D.	33·27	0 33 10		
,, 10	11 37	+1·49	+1·60	17 2 40	196 53 40	0		N.	33·61	0 35 19		
,, 17	11 24	+1·55	+1·56	17 3 20	196 53 30	0		V.G.G.	33·75	0 36 16	33·67	0 35 46
,, 24	11 38	+1·52	+1·57	17 4 17	196 53 30	0		N.	33·89	0 37 10		
,, 31	11 32	+1·49	+1·70	17 4 15	196 53 30	0		V.G.G.	33·85	0 36 57		
NOV. 7	11 42	+1·59	+1·57	17 2 45	196 53 32	0		N.	33·64	0 35 40		
,, 14	11 27	+1·54	+1·60	17 2 30	196 53 30	0		D.	33·60	0 35 22		
,, 21	11 36	+1·56	+1·56	17 3 10	196 53 20	0		V.G.G.	33·73	0 36 16	33·70	0 36 2
,, 28	11 34	+1·59	+1·51	17 4 10	196 53 45	5 E	0·66	D.	33·85	0 36 52		
DEC. 5	11 33	+1·55	+1·56	17 4 20	196 54 0	0		V.G.G.	33·82	0 36 46		
,, 12	11 34	+1·55	+1·55	17 3 20	196 54 40	0		D.	33·61	0 35 6		
,, 19	11 41	+1·55	+1·56	17 6 15	196 54 50	0		N.	34·05	0 37 51	33·78	0 36 12
,, 26	11 34	+1·51	+1·61	17 3 40	196 54 55	0		D.	33·63	0 35 4		

The Mean Declination for the year 1895 = 0 36 9

Absolute Magnetical Observations.—Table III.

OBSERVATIONS OF INCLINATION, 1895.

Taken with Barrow's Dip Circle, with Microscopes, No. 49 and two 3½-inch Needles, Nos. 1 and 2, by Dover, Charlton.

1895. Date.	Bombay Civil Time (0 to 24 hours). At commencement.	At conclusion.	Observer.	Needle marked.	End of Needle Dipping. A. Face of Circle. East.	A. Face of Circle. West.	B. Face of Circle. East.	B. Face of Circle. West.	Mean Dip.	Monthly Mean for each Needle.	Monthly Mean.
	h. m.	h. m.			° ′	° ′	° ′	° ′	° ′		° ′
JAN. 1	12 7	13 40	V.G.G.	1	21 5·7	21 20·9	20 11·5	20 27·0	20 46·3		
„ 4	14 25	15 49	N.	2	20 56·7	21 4·7	20 15·7	20 35·9	20 43·2	No. 1	
„ 8	12 9	13 28	D.	2	20 57·1	21 9·9	20 18·5	20 32·6	20 44·5	20° 45′·5	
„ 11	14 22	15 43	D.	1	21 0·0	21 21·5	20 14·2	20 26·9	20 45·6		
„ 15	12 7	13 38	N.	1	21 6·7	21 14·5	20 16·4	20 23·2	20 45·2		20 44·9
„ 18	14 30	15 58	N.	2	20 58·2	21 4·6	20 25·2	20 28·0	20 44·0	No. 2	
„ 22	11 57	13 25	D.	2	20 58·4	21 12·2	20 20·0	20 28·4	20 44·7	20° 44′·1	
„ 25	14 42	16 7	D.	1	21 9·0	21 13·7	20 18·7	20 17·5	20 44·7		
„ 29	12 27	13 45	V.G.G.	1	21 7·2	21 19·4	20 15·5	20 20·7	20 45·7		
FEB. 1	14 42	16 2	V.G.G.	2	21 3·2	21 10·2	20 24·4	20 26·5	20 46·1		
„ 5	12 9	13 34	D.	2	21 0·1	21 6·0	20 27·2	20 31·0	20 46·1	No. 1	
„ 8	14 41	16 3	D.	1	21 5·6	21 17·5	20 14·5	20 23·9	20 45·4	20° 46′·2	
„ 12	12 22	13 45	V.G.G.	1	21 9·2	21 25·0	20 12·7	20 19·0	20 46·5		
„ 15	14 45	16 5	V.G.G.	2	21 3·4	21 8·8	20 27·7	20 29·8	20 47·4		20 46·4
„ 19	12 20	13 45	V.G.G.	2	21 3·0	21 10·2	20 23·0	20 30·5	20 46·7	No. 2	
„ 23	14 46	16 12	V.G.G.	1	21 10·1	21 22·0	20 10·5	20 22·2	20 46·2	20° 46′·6	
„ 26	12 20	13 47	N.	1	21 10·7	21 19·9	20 13·6	20 22·4	20 46·6		
MAR. 1	14 34	16 2	N.	2	21 1·5	21 5·6	20 30·0	20 32·4	20 47·4		
„ 5	12 10	14 0	D.	2	21 7·2	21 0·7	20 22·0	20 31·6	20 45·4	No. 1	
„ 8	15 10	16 29	D.	1	21 2·0	21 18·7	20 21·8	20 22·0	20 46·1		
„ 12	12 7	13 37	N.	1	21 8·0	21 15·0	20 26·7	20 20·1	20 47·4	20° 46′·6	
„ 15	14 33	15 55	N.	2	21 9·5	21 2·9	20 28·0	20 27·2	20 46·9		20 46·4
„ 19	12 13	13 35	D.	2	21 3·0	21 9·1	20 22·2	20 28·5	20 45·7	No. 2	
„ 22	14 56	16 20	D.	1	21 3·0	21 17·1	20 22·0	20 22·1	20 46·0		
„ 26	12 10	13 38	N.	1	21 8·5	21 14·6	20 25·1	20 19·1	20 46·8	20° 46′·3	
„ 29	14 30	15 53	N.	2	21 7·1	21 6·9	20 25·9	20 24·6	20 46·1		
APRIL 2	12 1	13 26	D.	2	21 8·6	21 5·2	20 24·1	20 23·0	20 45·2		
„ 5	14 33	16 3	D.	1	21 12·0	21 12·2	20 21·4	20 18·7	20 46·1	No. 1	
„ 9	12 12	13 47	N.	1	21 13·2	21 17·5	20 20·7	20 17·2	20 47·1	20° 45′·9	
„ 12	14 26	15 48	N.	2	21 12·7	21 1·6	20 25·9	20 27·6	20 46·9		
„ 16	12 24	13 50	G.S.J.	2	21 7·9	21 4·2	20 17·5	20 28·7	20 44·6	No. 2	20 45·9
„ 19	14 42	16 3	D.	1	21 15·9	21 15·2	20 17·0	20 14·0	20 45·5	20° 45′·9	
„ 23	12 20	13 46	N.	1	21 10·7	21 21·6	20 10·7	20 16·4	20 44·8		
„ 26	14 33	16 0	N.	2	21 13·2	21 2·4	20 23·2	20 25·6	20 46·1		
„ 30	12 8	13 30	D.	2	21 11·4	21 0·7	20 20·9	20 33·2	20 46·5		

1895. Date.	Bombay Civil Time (0 to 24 hours). At commencement.	At conclusion.	Observer.	Needle marked.	End of Needle Dipping. A. Face of Circle. East.	A. Face of Circle. West.	B. Face of Circle. East.	B. Face of Circle. West.	Mean Dip.	Monthly Mean for each Needle.	Monthly Mean.
	h. m.	h. m.			° ′	° ′	° ′	° ′	° ′		° ′
MAY 3	15 37	17 1	D.	1	21 7·2	21 16·4	20 15·9	20 18·4	20 44·5		
„ 7	12 20	13 50	N.	1	21 9·2	21 12·5	20 20·7	20 16·9	20 44·8	No. 1	
„ 10	14 25	15 50	N.	2	21 5·9	21 6·2	20 23·2	20 34·9	20 47·5	° ′	
„ 14	12 8	13 38	D.	2	21 8·0	21 10·7	20 25·5	20 29·6	20 48·4	20 45·3	
„ 17	15 7	16 31	D.	1	21 13·7	21 13·5	20 15·2	20 20·7	20 45·8		20 46·6
„ 21	12 6	13 32	N.	1	21 6·7	21 18·4	20 14·0	20 22·2	20 45·3	No. 2	
„ 24	14 23	15 47	N.	2	21 12·1	21 5·4	20 21·2	20 31·6	20 47·6	° ′	
„ 28	12 3	13 31	D.	2	21 14·5	21 9·2	20 20·6	20 32·9	20 49·3	20 48·2	
„ 31	15 22	16 43	D.	1	21 10·7	21 16·6	20 10·5	20 26·2	20 46·0		
JUNE 4	12 10	13 34	N.	1	21 6·7	21 20·7	20 15·0	20 27·6	20 47·5		
„ 7	14 27	15 59	N.	2	21 13·0	21 11·6	20 16·9	20 33·6	20 48·8	No. 1	
„ 11	12 5	13 30	D.	2	21 15·5	21 8·4	20 20·6	20 32·2	20 49·2	° ′	
„ 14	15 30	16 53	D.	1	21 11·6	21 19·0	20 19·2	20 23·1	20 48·2	20 48·6	20 48·7
„ 18	12 22	13 47	V.G.G.	1	21 11·1	21 20·4	20 19·2	20 26·6	20 49·3		
„ 21	14 25	15 53	N.	2	21 11·0	21 12·5	20 19·2	20 34·2	20 49·2	No. 2	
„ 25	12 13	13 35	D.	2	21 5·4	21 11·0	20 23·7	20 32·2	20 48·1	° ′	
„ 28	15 8	16 32	D.	1	21 10·5	21 19·2	20 23·0	20 24·9	20 49·4	20 48·8	
JULY 2	12 16	13 42	N.	1	21 9·6	21 20·0	20 23·1	20 26·4	20 49·8		
„ 5	14 28	15 49	N.	2	21 3·6	21 14·0	20 25·9	20 31·7	20 48·8		
„ 9	12 8	13 35	D.	2	20 58·1	21 13·7	20 34·9	20 30·1	20 49·2	No. 1	
„ 12	14 51	16 20	D.	1	21 7·9	21 25·1	20 23·5	20 25·0	20 50·4	° ′	
„ 16	12 15	13 39	N.	1	21 9·9	21 23·0	20 24·6	20 24·1	20 50·4	20 49·7	20 49·4
„ 19	14 23	15 45	N.	2	20 54·6	21 15·6	20 34·2	20 31·0	20 48·8		
„ 23	11 50	13 16	D.	2	20 56·8	21 15·7	20 30·7	20 33·9	20 49·3	No. 2	
„ 26	14 39	16 2	D.	1	21 5·1	21 20·1	20 22·7	20 29·4	20 49·3	° ′	
„ 30	12 5	13 36	N.	1	21 2·4	21 22·4	20 17·6	20 32·4	20 48·7	20 49·0	
AUG. 2	14 25	15 47	N.	2	20 55·6	21 17·0	20 31·6	20 33·5	20 49·4		
„ 6	12 26	13 52	D.	2	20 52·7	21 19·5	20 29·4	20 37·8	20 49·8		
„ 9	14 49	16 12	D.	1	21 6·7	21 21·1	20 13·6	20 28·6	20 47·5	No. 1	
„ 12	12 17	13 42	N.	1	21 2·0	21 23·7	20 9·2	20 32·1	20 46·7	° ′	
„ 16	14 27	15 51	N.	2	20 53·0	21 22·4	20 24·4	20 40·0	20 49·9	20 47·8	20 48·9
„ 20	12 0	13 22	D.	2	20 46·7	21 20·1	20 24·2	20 46·4	20 49·3		
„ 24	14 48	16 31	D.	1	20 58·9	21 20·5	20 24·2	20 31·4	20 48·7	No. 2	
„ 27	12 14	13 37	N.	1	20 53·4	21 25·5	20 19·1	20 36·2	20 48·5	° ′	
„ 30	14 28	15 52	N.	2	20 48·1	21 24·5	20 16·7	20 51·7	20 50·2	20 49·6	

1895. Date.	Bombay Civil Time (0 to 24 hours). At commencement.	At conclusion.	Observer.	Needle marked.	End of Needle Dipping. A. Face of Circle. East.	A. Face of Circle. West.	B. Face of Circle. East.	B. Face of Circle. West.	Mean Dip.	Monthly Mean for each Needle.	Monthly Mean.
	h. m.	h. m.			° ′	° ′	° ′	° ′	° ′		° ′
Sept. 3	11 59	13 28	D.	2	20 49·5	21 22·9	20 11·7	20 55·0	20 49·8		
„ 6	14 59	16 24	D.	1	20 54·0	21 28·9	20 16·2	20 43·0	20 50·5	No. 1	
„ 10	12 0	13 26	N.	1	20 48·2	21 33·7	20 11·1	20 42·0	20 48·7	20 49·5	
„ 13	14 30	15 56	N.	2	20 44·6	21 25·6	20 9·0	20 59·2	20 49·6		20 49·5
„ 17	12 2	13 28	D.	2	20 44·6	21 22·1	20 10·7	21 2·7	20 50·0	No. 2	
„ 20	15 9	16 38	D.	1	20 45·0	21 38·6	20 11·9	20 42·6	20 49·5	20 49·6	
„ 24	12 5	13 30	N.	1	20 45·5	21 38·6	20 7·9	20 44·8	20 49·2		
„ 27	14 16	15 40	N.	2	20 38·5	21 27·4	20 5·6	21 4·2	20 48·9		
Oct. 1	12 21	13 46	D.	2	20 36·7	21 30·6	20 7·5	21 3·4	20 49·5		
„ 4	15 5	16 28	D	1	20 47·9	21 36·9	20 9·4	20 41·1	20 48·8	No. 1	
„ 8	12 17	13 43	N.	1	20 51·4	21 38·7	20 4·6	20 44·5	20 49·8	20 49·5	
„ 11	14 22	15 47	N.	2	20 36·4	21 33·6	20 5·9	21 5·0	20 50·2		
„ 15	12 25	13 44	V.G.G.	2	20 39·9	21 32·7	20 4·2	21 3·5	20 50·1		20 49·9
„ 19	14 35	16 4	V.G.G.	1	20 54·4	21 39·7	20 1·7	20 41·2	20 49·2	No. 2	
„ 22	12 9	13 36	N.	1	20 49·5	21 44·2	20 0·5	20 46·6	20 50·2	20 50·1	
„ 25	14 50	16 9	N.	2	20 41·0	21 35·0	20 1·1	21 4·2	20 50·3		
„ 29	12 23	13 41	V.G.G.	2	20 41·4	21 35·6	20 3·7	21 1·6	20 50·6		
Nov. 1	14 47	16 3	V.G.G.	1	20 53·1	21 41·4	19 59·5	20 45·7	20 49·9		
„ 5	12 11	13 33	N.	1	20 54·5	21 38·5	20 4·2	20 45·9	20 50·8	No. 1	
„ 8	14 30	15 54	N.	2	20 40·7	22 36·5	20 8·0	21 3·0	20 52·0	20 50·9	
„ 12	12 9	13 33	D.	2	20 44·5	21 38·2	20 4·0	21 3·4	20 52·5		
„ 15	15 4	16 25	D.	1	20 57·5	21 36·1	20 5·5	20 48·4	20 51·9		20 51·8
„ 19	12 20	13 45	V.G.G.	1	20 58·0	21 41·0	20 1·4	20 46·5	20 51·7	No 2	
„ 22	14 45	16 10	V.G.G.	2	20 42·9	21 40·5	20 11·5	21 1·9	20 54·2	20 52·8	
„ 26	12 23	13 56	D.	2	20 46·1	21 38·2	20 10·0	20 56·6	20 52·7		
„ 29	14 45	16 25	D.	1	20 50·9	21 41·4	20 14·5	20 34·1	20 50·2		
Dec. 3	12 20	13 50	V.G.G.	1	21 3·1	21 37·7	20 9·5	20 43·1	20 53·3		
„ 6	14 29	15 54	V.G.G.	2	20 50·7	21 36·4	20 16·2	20 54·2	20 54·4	No. 1	
„ 10	12 2	13 22	D.	2	20 48·7	21 40·7	20 22·0	20 51·9	20 55·8	20 52·8	
„ 13	14 3	15 28	D.	1	21 0·1	21 32·5	20 11·7	20 44·1	20 52·1		
„ 17	12 25	13 54	V.G.G.	1	21 2·0	21 34·7	20 14·9	20 41·5	20 53·3		20 53·8
„ 20	14 26	15 50	N.	2	20 45·1	21 36·4	20 17·5	20 59·0	20 54·5		
„ 24	12 45	14 10	D.	2	20 48·6	21 37·5	20 19·6	20 57·1	20 55·7	No. 2	
„ 27	14 38	16 0	V.G.G.	1	21 3·2	21 32·5	20 17·0	20 38·7	20 52·8	20 55·1	
„ 31	12 5	13 28	N.	1	20 57·1	21 37·4	20 12·2	20 42·4	20 52·3		

The Mean Dip for the year ... { With Needle No. 1 = 20 48·2 / With Needle No. 2 = 20 48·8

The Mean Dip for the year 1895 = 20 48·5

Absolute Magnetical Observations.—Table III *a*.

SUPPLEMENTARY OBSERVATIONS OF INCLINATION, 1895.

Taken with Barrow's Dip Circle, with Microscopes, No. 49 and two 3½-inch Needles, Nos. $\frac{1}{81}$ and $\frac{2}{81}$, by John Dover.

1895. Date.	Bombay Civil Time (0 to 24 hours). At commencement.	At conclusion.	Observer.	Needle marked.	End of Needle Dipping. A. Face of Circle. East.	A. Face of Circle. West.	B. Face of Circle. East.	B. Face of Circle. West.	Mean Dip.	Monthly Mean for each Needle.	Monthly Mean.
	h. m	h. m.			° ′	° ′	° ′	° ′	° ′		° ′
JAN. 1	11 10	14 33	V.G.G.	$\frac{1}{81}$	20 40·0	21 3·9	20 39·0	20 33·0	20 44·0		
„ 4	13 33	16 45	N.	$\frac{2}{81}$	20 37·4	20 43·9	20 33·7	20 46·7	20 40·4	No. $\frac{1}{81}$	
„ 8	11 14	14 24	D.	$\frac{2}{81}$	20 35·1	20 45·7	20 35·4	20 42·6	20 39·7	20 43·7	
„ 11	13 29	16 43	D.	$\frac{1}{81}$	20 40·6	21 7·6	20 32·6	20 33·2	20 43·5		
„ 15	11 12	14 36	N.	$\frac{1}{81}$	20 41·2	21 1·7	20 32·0	20 36·1	20 42·7		20 42·2
„ 18	13 38	16 51	N.	$\frac{2}{81}$	20 41·5	20 42·4	20 36·0	20 39·7	20 39·9	No. $\frac{2}{81}$	
„ 22	11 3	14 19	D.	$\frac{2}{81}$	20 40·4	20 44·7	20 38·1	20 41·7	20 41·2	20 40·3	
„ 25	13 48	17 1	D.	$\frac{1}{81}$	20 45·7	21 2·0	20 32·1	20 35·2	20 43·7		
„ 29	11 30	14 35	V.G.G.	$\frac{1}{81}$	20 42·1	21 0·6	20 38·0	20 38·2	20 44·7		
FEB. 1	13 50	17 4	V.G.G.	$\frac{2}{81}$	20 39·5	20 47·2	20 42·5	20 39·4	20 42·1		
„ 5	11 11	14 24	D.	$\frac{2}{81}$	20 38·0	20 50·6	20 37·9	20 37·1	20 40·9	No. $\frac{1}{81}$	
„ 8	13 50	17 0	D.	$\frac{1}{81}$	20 42·0	20 58·7	20 31·7	20 38·7	20 42·8	20 43·7	
„ 12	11 30	14 38	V.G.G.	$\frac{1}{81}$	20 47·6	21 2·0	20 31·0	20 34·2	20 43·7		20 42·6
„ 15	13 51	17 0	V.G.G.	$\frac{2}{81}$	20 34·0	20 55·4	20 42·0	20 35·7	20 41·8		
„ 19	11 25	14 40	V.G.G.	$\frac{2}{81}$	20 37·6	20 55·6	20 36·1	20 36·2	20 41·4	No. $\frac{2}{81}$	
„ 23	13 53	17 5	V.G.G.	$\frac{1}{81}$	20 49·7	21 5·2	20 28·9	20 30·5	20 43·6	20 41·5	
„ 26	11 25	14 42	N.	$\frac{1}{81}$	20 49·2	21 1·6	20 34·5	20 34·4	20 44·9		
MAR. 1	13 41	16 56	N.	$\frac{2}{81}$	20 42·1	20 53·6	20 32·1	20 42·5	20 42·6		
„ 5	11 14	15 0	D.	$\frac{2}{81}$	20 41·6	20 53·2	20 27·7	20 42·6	20 41·3	No. $\frac{1}{81}$	
„ 8	14 20	17 22	D.	$\frac{1}{81}$	20 48·5	21 2·2	20 38·6	20 32·6	20 45·5	20 46·2	
„ 12	11 14	14 36	N.	$\frac{1}{81}$	20 50·0	20 58·1	20 40·6	20 36·2	20 46·2		
„ 15	13 37	16 46	N.	$\frac{2}{81}$	20 48·2	20 47·2	20 30·0	20 43·5	20 42·2		20 43·8
„ 19	11 19	14 38	D.	$\frac{2}{81}$	20 48·5	20 48·0	20 22·2	20 48·6	20 41·8		
„ 22	14 5	17 14	D.	$\frac{1}{81}$	20 53·6	20 58·6	20 38·9	20 34·5	20 46·4	No. $\frac{2}{81}$	
„ 26	11 18	14 35	N.	$\frac{1}{81}$	20 55·5	20 54·9	20 41·5	20 35·4	20 46·8	20 41·9	
„ 29	13 36	16 43	N.	$\frac{2}{81}$	20 51·9	20 44·2	20 27·8	20 43·2	20 41·8		
APR. 2	11 9	14 20	D.	$\frac{2}{81}$	20 54·0	20 41·7	20 31·1	20 45·1	20 43·0		
„ 5	13 39	16 56	D.	$\frac{1}{81}$	21 2·2	20 51·2	20 38·6	20 32·2	20 46·0	No. $\frac{1}{81}$	
„ 9	11 20	14 41	N.	$\frac{1}{81}$	20 58·5	20 51·4	20 41·0	20 36·6	20 46·9	20 46·3	
„ 12	13 35	16 43	N.	$\frac{2}{81}$	20 54·6	20 40·0	20 36·6	20 43·2	20 43·6		
„ 16	11 32	14 43	G.S.J.	$\frac{2}{81}$	20 52·0	20 42·6	20 32·5	20 41·6	20 42·2		20 44·5
„ 19	13 49	16 57	D.	$\frac{1}{81}$	20 58·5	20 52·2	20 34·7	20 38·0	20 45·8		
„ 23	11 26	14 40	N.	$\frac{1}{81}$	20 53·4	20 57·2	20 33·6	20 42·0	20 46·5	No. $\frac{2}{81}$	
„ 26	13 40	16 48	N.	$\frac{2}{81}$	20 53·1	20 43·2	20 39·5	20 37·1	20 43·2	20 43·0	
„ 30	11 3	14 34	D.	$\frac{2}{81}$	20 54·1	20 49·1	20 33·7	20 34·7	20 42·9		

1895. Date.	Bombay Civil Time (0 to 24 hours). At commencement.	At conclusion.	Observer.	Needle marked.	End of Needle Dipping. A. Face of Circle. East.	A. Face of Circle. West.	B. Face of Circle. East.	B. Face of Circle. West.	Mean Dip.	Monthly Mean for each Needle.	Monthly Mean.
	h. m.	h. m.			° ′	° ′	° ′	° ′	° ′		° ′
MAY 3	14 47	17 55	D.	$\frac{1}{81}$	20 53·2	20 53·8	20 34·5	20 40.2	20 45·4		
,, 7	11 28	14 44	N.	$\frac{1}{81}$	20 52·1	20 52·1	20 39·1	20 41·6	20 46·2	No. $\frac{1}{81}$	
,, 10	13 30	16 42	N.	$\frac{2}{81}$	20 52·4	20 46·5	20 39·1	20 35·6	20 43·4	20 46·2	
,, 14	11 15	14 33	D.	$\frac{2}{81}$	20 45·7	20 43·7	20 37·2	20 43·2	20 42·4		
,, 17	14 16	17 30	D.	$\frac{1}{81}$	20 55·5	20 51.6	20 34·5	20 47·4	20 47·2		20 44·3
,, 21	11 13	14 27	N.	$\frac{1}{81}$	20 49·4	20 55·1	20 27·6	20 53·7	20 46·4		
,, 24	13 40	16 42	N.	$\frac{2}{81}$	20 42·5	20 44·4	20 39·1	20 39·1	20 41·3	No. $\frac{2}{81}$	
,, 28	11 10	14 25	D.	$\frac{2}{81}$	20 38·0	20 40·9	20 35·0	20 48·0	20 40·5	20 41·9	
,, 31	14 29	17 37	D.	$\frac{1}{81}$	20 47·0	20 52·2	20 25·2	20 58·6	20 45·7		
JUNE 4	11 15	14 29	N.	$\frac{1}{81}$	20 49·7	20 47·9	20 29·2	21 1·9	20 47·2		
,, 7	13 32	16 46	N.	$\frac{2}{81}$	20 39·2	20 37·1	20 36·5	20 46·6	20 39·8	No. $\frac{1}{81}$	
,, 11	11 12	14 30	D.	$\frac{2}{81}$	20 33·9	20 41·7	20 40·7	20 43·4	20 39·9	20 46·4	
,, 14	14 39	17 48	D.	$\frac{1}{81}$	20 45·5	20 48·7	20 27·9	21 4·0	20 46·5		20 43·1
,, 18	11 25	14 40	V.G.G.	$\frac{1}{81}$	20 45·4	20 43·4	20 29·9	21 4·7	20 45·8		
,, 21	13 30	16 46	N.	$\frac{2}{81}$	20 33·4	20 42·9	20 36·2	20 44·6	20 39·3	No. $\frac{2}{81}$	
,, 25	11 20	15 3	D.	$\frac{2}{81}$	20 28·0	20 48·0	20 37·2	20 47·2	20 40·1	20 39·8	
,, 28	14 16	17 24	D.	$\frac{1}{81}$	20 48·4	20 42·7	20 27·7	21 5·5	20 46·1		
JULY 2	11 25	14 37	N.	$\frac{1}{81}$	20 44·3	20 49·5	20 31·4	21 1·6	20 46·7		
,, 5	13 37	16 40	N.	$\frac{2}{81}$	20 32·7	20 45·0	20 39·4	20 44·7	20 40·4	No. $\frac{1}{81}$	
,, 9	11 15	14 30	D.	$\frac{2}{81}$	20 33·5	20 52·9	20 36·2	20 40·1	20 40·7	20 47·3	
,, 12	13 55	17 11	D.	$\frac{1}{81}$	20 45·2	20 42·9	20 26·2	21 12·2	20 46·6		
,, 16	11 24	14 38	N.	$\frac{1}{81}$	20 45·4	20 43·9	20 30·9	21 8·2	20 47·1		20 44·6
,, 19	13 30	16 37	N.	$\frac{2}{81}$	20 34·1	20 54·5	20 35·0	20 41·9	20 41·4		
,, 23	11 0	14 12	D.	$\frac{2}{81}$	20 31·7	20 54·2	20 39·7	20 44·9	20 42·6	No. $\frac{2}{81}$	
,, 26	13 49	17 2	D.	$\frac{1}{81}$	20 46·1	20 46·6	20 36·0	21 4·4	20 48·3	20 41·3	
,, 30	11 14	14 29	N.	$\frac{1}{81}$	20 46·1	20 46·0	20 33·2	21 6·2	20 47·9		
AUG. 2	13 32	16 39	N.	$\frac{2}{81}$	20 28·5	20 58·5	20 36·7	20 49·1	20 43·2		
,, 6	11 21	14 49	D.	$\frac{2}{81}$	20 31·4	20 59·5	20 35·7	20 54·2	20 45·2	No. $\frac{1}{81}$	
,, 9	13 46	17 5	D.	$\frac{1}{81}$	20 45·6	20 53·4	20 28·9	21 1·0	20 47·2	20 47·7	
,, 12	11 27	14 33	N.	$\frac{1}{81}$	20 38·4	20 57·5	20 29·2	21 3·4	20 47·1		
,, 16	13 33	16 42	N.	$\frac{2}{81}$	20 26·4	21 3·9	20 39·5	20 50·1	20 45·0		20 46·0
,, 20	11 5	14 18	D.	$\frac{2}{81}$	20 34·0	20 58·7	20 33·9	20 50·7	20 44·3	No. $\frac{2}{81}$	
,, 24	13 55	17 23	D.	$\frac{1}{81}$	20 40·5	20 58·1	20 33·3	21 2·0	20 48·5	20 44·5	
,, 27	11 22	14 34	N.	$\frac{1}{81}$	20 38·2	21 0·9	20 32·7	21 0·9	20 48·2		
,, 30	13 34	16 44	N.	$\frac{2}{81}$	20 28·4	21 5·7	20 38·6	20 47·5	20 45·0		

1895. Date.	Bombay Civil Time (0 to 24 hours). At commencement.	At conclusion.	Observer.	Needle marked.	End of Needle Dipping. A. Face of Circle. East.	A. Face of Circle. West.	B. Face of Circle. East.	B. Face of Circle. West.	Mean Dip.	Monthly Mean for each Needle.	Monthly Mean.
	h. m.	h. m.			° ′	° ′	′	° ′	° ′		° ′
SEPT. 3	11 4	14 28	D.	$\frac{2}{81}$	20 29·6	21 0·1	20 33·7	20 51·2	20 43·6		
„ 6	14 7	17 19	D.	$\frac{1}{81}$	20 45·9	20 59·5	20 30·5	21 3·5	20 49·8	No. $\frac{1}{81}$	
„ 10	11 5	14 26	N.	$\frac{1}{81}$	20 42·9	21 4·6	20 25·0	21 5·6	20 49·5	20 49·8	
„ 13	13 36	16 46	N.	$\frac{2}{81}$	20 27·1	21 5·4	20 30·2	20 53·1	20 43·9		
„ 17	11 10	14 23	D.	$\frac{2}{81}$	20 26·4	21 4·7	20 33·1	20 57·4	20 45·4		20 47·1
„ 20	14 20	17 31	D.	$\frac{1}{81}$	20 44·7	21 7·1	20 23·4	21 5·1	20 50·1	No. $\frac{2}{81}$	
„ 24	11 11	14 24	N.	$\frac{1}{81}$	20 41·5	21 6·6	20 23·0	21 7·9	20 49·7	20 44·5	
„ 27	13 23	16 34	N.	$\frac{2}{81}$	20 21·0	21 9·1	20 30·7	20 59·7	20 45·1		
OCT. 1	11 29	14 40	D.	$\frac{2}{81}$	20 24·3	21 9·2	20 35·7	21 0·0	20 47·3		
„ 4	14 15	17 23	D.	$\frac{1}{81}$	20 38·9	21 10·4	20 16·5	21 9·9	20 48·9	No. $\frac{1}{81}$	
„ 8	11 26	14 34	N.	$\frac{1}{81}$	20 37·9	21 9·4	20 22·2	21 13·7	20 50·8	20 50·2	
„ 11	13 29	16 41	N.	$\frac{2}{81}$	20 23·2	21 8·9	20 34·1	21 6·0	20 48·0		
„ 15	11 30	14 33	V.G.G.	$\frac{2}{81}$	20 28·2	21 6·0	20 33·5	21 6·1	20 48·4		20 49·3
„ 19	13 50	16 59	V.G.G.	$\frac{1}{81}$	20 40·6	21 9·0	20 19·5	21 11·0	20 50·0		
„ 22	11 20	14 31	N.	$\frac{1}{81}$	20 37·1	21 11·7	20 22·4	21 13·4	20 51·1	No. $\frac{2}{81}$	
„ 25	13 58	17 3	N.	$\frac{2}{81}$	20 27·0	21 12·0	20 29·4	21 9·7	20 49·5	20 48·7	
„ 29	11 27	14 30	V.G.G.	$\frac{2}{81}$	20 28·0	21 14·4	20 27·5	21 10·7	20 50·1		
NOV. 1	13 55	16 56	V.G.G.	$\frac{1}{81}$	20 39·7	21 6·7	20 22·2	21 17·2	20 51·4		
„ 5	11 20	14 41	N.	$\frac{1}{81}$	20 34·9	21 12·2	20 24·7	21 17·7	20 52·4	No. $\frac{1}{81}$	
„ 8	13 39	16 46	N.	$\frac{2}{81}$	20 31·2	21 12·6	20 29.6	21 11·5	20 51·2	20 53·5	
„ 12	11 14	14 34	D.	$\frac{2}{81}$	20 27·6	21 15·0	20 26·6	21 10·9	20 50·0		
„ 15	14 15	17 19	D.	$\frac{1}{81}$	20 31·7	21 11·0	20 27·6	21 24·1	20 53·6		20 52·6
„ 19	11 30	14 37	V.G.G.	$\frac{1}{81}$	20 31·1	21 14·0	20 31·2	21 16·5	20 53·2		
„ 22	13 50	17 3	V.G.G.	$\frac{2}{81}$	20 23.0	21 17·2	20 30·1	21 16·7	20 51·7	No $\frac{2}{81}$	
„ 26	11 29	14 51	D.	$\frac{2}{81}$	20 25·1	21 15·2	20 29·6	21 20·1	20 52·5	20 51·3	
„ 29	13 29	17 51	D.	$\frac{1}{81}$	20 29·0	21 19·4	20 41·9	21 18·2	20 57·1		
DEC. 3	11 27	14 45	V.G.G.	$\frac{1}{81}$	20 34·6	21 9·5	20 44·1	21 14·6	20 55·7		
„ 6	13 40	16 52	V.G.G.	$\frac{2}{81}$	20 30·2	21 13·5	20 33·5	21 16·2	20 53·3	No $\frac{1}{81}$	
„ 10	11 1	14 14	D.	$\frac{2}{81}$	20 29.9	21 16·5	20 28·6	21 20·1	20 53·8	20 56·2	
„ 13	13 12	16 25	D.	$\frac{1}{81}$	20 35·5	21 14·9	20 42·9	21 14·3	20 56·9		
„ 17	11 30	14 50	V.G.G.	$\frac{1}{81}$	20 38·1	21 15·7	20 39·6	21 10·4	20 55·9		20 54·8
„ 20	13 35	16 50	N.	$\frac{2}{81}$	20 26·7	21 10·7	20 33·4	21 16·1	20 51·7		
„ 24	11 52	15 2	D.	$\frac{2}{81}$	20 29·4	21 16·2	20 30·5	21 18·5	20 53·6	No. $\frac{2}{81}$	
„ 27	13	16 55	V.G.G.	$\frac{1}{81}$	20 40·5	21 13·0	20 42·4	21 11·2	20 56·8	20 53·1	
„ 31	11 15	14 22	N.	$\frac{1}{81}$	20 46.6	21 6·4	20 39·9	21 10·9	20 55·9		

The Mean Dip for the year... With Needle No. $\frac{1}{81}$ = ° ′ 20 48·2

With Needle No. $\frac{2}{81}$ = 20 44·3

The Mean Dip for the year 1895 = ° ′ 20 46·3

FIFTY YEARS OF

METEOROLOGICAL AND MAGNETICAL OBSERVATIONS

AT THE

GOVERNMENT OBSERVATORY, COLABA.

SOURCE AND EXPLANATION OF THE METHODS OF REDUCTION OF ENTRIES IN THE TABLES 1—6.

In completing the following tables the entries given in the published volumes have been invariably adopted. It is only where a few entries were not so available, that the original manuscript abstracts were consulted and the missing entries filled in. In every case the modes of operation have been precisely the same as those adopted in reducing the entries given in the printed volumes, and in no case has a new departure from the usual methods been attempted.

Tables 1 and 2.

Barometer and Temperature of the Air.

1846. Monthly means were taken from the manuscript abstracts from which annual means were calculated and adopted. All other entries of the year have been taken from the manuscript abstracts directly.

1847—1895. From 1847 to 1872 all entries have been taken directly from the Meteorology of the Bombay Presidency, and from 1873 to 1895 from the volumes 23 to 34 of Bombay Magnetical and Meteorological Observations.

Table 3.

Pressure of Vapour.

1846. Monthly means of dry and wet-bulb thermometers taken from manuscript abstracts were reduced to monthly means of pressure of vapour by the formula given in the Meteorology of the Bombay Presidency for the years 1847 to 1861. The maxima and minima were derived by a process of inspection and reduced as above.

1847—1895. From 1847 to 1872 the entries have been taken directly from the Meteorology of the Bombay Presidency and from 1873 to 1895 from volumes 23 to 34 of Bombay Magnetical and Meteorological Observations.

Table 4.

Wind.

1846. Monthly means of pressure in lbs. per square foot were taken from manuscript abstracts from which the annual mean was calculated and adopted. Hourly, daily and monthly maximum pressures were directly obtained from the abstracts and adopted. For the average direction of the year, instead of getting the daily average from 24 hourly observations, a particular mean hourly direction was selected which corresponded with the average direction of the day, to which the usual average process was applied, and from the monthly means so derived the annual mean was finally obtained and adopted.

1847—1872. Annual mean pressure in lbs. per square foot for the years 1847 to 1865 given in volumes 3 to 22 were taken directly and adopted, as also the annual average directions for the years 1847 to 1863. The force of wind in 8 principal directions during the years 1864 and 1865 and in 16 directions in the years 1866 and 1867 as given in the volumes 21 and 22 were taken and resolved into north and east components, and resultant directions were found therefrom and adopted. Annual mean velocities for 1866 to 1872 as given in volumes 22 and 23 were directly adopted. Mean resultant directions for 1868 to 1872 were derived from the annual components of wind given in volumes 22 and 23, and adopted. All other entries for 1847 to 1872 were directly taken from the Meteorology of the Bombay Presidency.

1873—1895. Annual mean velocities and maximum mean daily and monthly velocities have been taken from Bombay Magnetical and Meteorological Observations, volumes 23 to 34. Mean resultant directions were reduced from the annual components of wind given in the above volumes and adopted. Maximum hourly mean velocities were derived from data prepared for the yearly Government administration reports.

Table 5.

Rainfall.

1846—1872. All entries have been taken directly from the Meteorology of the Bombay Presidency except that of maximum *daily* rainfall for the year 1846, which was taken from manuscript abstracts.

1873—1895. All entries have been taken from volumes 23 to 34 of the Bombay Magnetical and Meteorological Observations.

Table 6.

Declination.

1846. Monthly means of Grubb's declination magnetometer converted into minutes of arc were copied from manuscript abstracts, and the calculated mean of 12 months (the decimal part of the mean being converted into nearest seconds of arc) was adopted in the table.

1847—1867. Annual means in minutes of arc for the years 1847 to 1864 obtained from observations of Grubb's declination magnetometer were directly taken from volumes 3 to 22 of Bombay Magnetical and Meteorological Observations, the decimal parts of the means being converted into nearest seconds. The annual mean of 1865 being not available in the volume of that year, 12 monthly means in minutes of arc were taken from the original manuscript abstracts and duly converted into the annual mean. The annual mean for 1866 from weekly observations taken by old declinometer is the average of eleven monthly means only, mean for June being not available. The mean of 1867 is made up partly of observations by the old declinometer from January to May and by the new Kew pattern unifilar magnetometer from July to December. No observations appear to have been made in June of this year also. The two separate means given in volume 22 were taken and a new mean obtained, due regard being paid to the unequal periods. This was adopted as the annual mean.

1868—1895. Annual means obtained from weekly observations by Kew pattern magnetometer in minutes and seconds were directly adopted from the volumes 22 to 34.

Horizontal Force.

1846. From the daily means obtained from the manuscript abstracts of observations of the Grubb's horizontal force magnetometer and its thermometer, monthly means were calculated. The mean for the month of January was excluded, and eleven monthly means alone were taken to obtain the annual mean. The reason of the exclusion of the January mean is that the instrument was found out of adjustment on 2nd February, and fresh adjustments were made immediately—entries of the first two days of February being also omitted from the calculations of the mean of that month. The mean for April was taken from observations of the first 10 days only, those of the rest of the month being excluded, as the readings of the instrument during the time showed a gradual falling off which was found at the end of the month to be due to attachment of cobwebs, on the removal of which on 1st May the magnet returned to its mormal reading. Eleven (monthly) means denoting the scale readings were reduced to forces by the following formula :—

$$7{\cdot}953 + {\cdot}0075\ \{f - {\cdot}0027\ N + 32\ (t - 80) - 20{\cdot}00\}$$

f=scale reading; N=number of days backward from 1st January 1847, and t=monthly mean of thermometer of Grubb's horizontal force taken from the volume of 1847 and then a mean of the eleven forces was obtained. To reduce this to the m.m.—m g.—s. units the factor ·46108 was used, and the mean so obtained was adopted as the annual mean.

1847—1863. Annual means derived from Grubb's horizontal force magnetometer were directly taken from the volumes 3 to 20 and reduced by the factor ·46108 to the m.m.—m.g.—s. units.

1864—1867. Annual means derived from weekly observations of old magnetometers and given in volumes 21 and 22 were taken and converted into m.m.—m.g.—s.—units as stated above; the mean for 1865 is from eleven monthly means only, one —that of December—being omitted, as the value appears to be somewhat inconsistent.

1868—1895. Annual means determined from weekly observations with the Kew pattern unifilar magnetometer given in volumes 22 to 34 were taken and reduced to m.m.—m.g.—s.—units as before for 1868 to 1870. All entries from 1871 being given in m.m.—m.g.—s. units they were directly adopted.

Dip.

1846. In the printed volume 2 of 1846, monthly means of only eleven months were given, that of July being not recorded. The yearly mean, therefore, is the average of *eleven* monthly means only. The observations were made by the old instrument.

1847—1866 The annual means given in volumes 3 to 22 were adopted in the table, except for the years 1852 and 1853, the volumes of which years give the monthly means only from which the annual means were calculated and adopted in the table.

1867. During this year a change was made in the instruments, the old instrument being replaced by a new Kew dip Circle in April. Two means given in the volume of the year—one for the period January to April and the other from April to December—were taken, and due weight being given to the inequality in the periods, a new mean was obtained which was adopted as the annual mean.

1868—1895. Vaules of annual means taken from bi-weekly observations of the Kew dip circle were obtained from the volumes 22 to 34 and directly adopted, except for the year 1870, in which year two means are registered in the volume from which a new mean was obtained and adopted. For the year 1881 two separate means taken from the volume are retained, and no annual mean is attempted, as the two means appear to give somewhat discordant results.

Table 1.—Barometric Pressure.

1846–1895.

Year.	Annual mean.	Individual hours.			Daily means.			Monthly means.		
		Maximum.	Minimum.	Extreme range.	Maximum.	Minimum.	Range	Maximum.	Minimum.	Range.
	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.
1846 ...	29·809	30·107	29·383	0·724	30·032	29·493	0·539	**29·993**	29·624	0·369
1847 ...	·797	·075	·458	·617	·017	·498	·519	·917	·621	·296
1848 ...	·805	·084	·445	·639	·012	·491	·521	·927	·649	·278
1849 ...	·798	·094	·387	·707	·016	·428	·588	·945	·624	·321
1850 ...	·808	·070	·482	·588	29·998	·521	·477	·949	·639	·310
1851 ...	·796	·148	·414	·734	30·036	·462	·574	·958	**·599**	·359
1852 ...	·805	·072	·433	·639	·001	·485	·516	·929	·630	·299
1853 ...	·814	·113	·502	·611	·022	·536	·486	·955	·644	·311
1854 ...	·804	·111	**·183**	·928	·031	·514	·517	·935	·618	·317
1855 ...	·824	·119	·462	·657	·048	·513	·535	·944	·658	·286
1856 ...	·806	·136	·439	·697	·068	·524	·544	·985	·610	·375
1857 ...	·808	·105	·507	·598	·039	·541	·498	·981	·640	·341
1858 ...	·812	·093	·464	·629	·018	·516	·502	·944	·670	·274
1859 ...	·812	·061	·437	·624	29·994	·492	·502	·933	·628	·305
1860 ...	·804	·095	·452	·643	30·012	·496	·516	·953	·631	·322
1861 ...	·797	·053	·429	·624	29·975	·506	·469	·932	·639	·293
1862 ...	·783	·101	·467	·634	30·017	·511	·506	·920	·625	·295
1863 ...	·792	·108	·457	·651	·018	·500	·518	·947	·606	·341
1864 ...	·832	·142	·486	·656	·054	·567	·487	·945	·660	·285
1865 ...	·811	·109	·456	·653	·039	·496	·543	·972	·656	·316
1866 ...	·822	**·164**	·342	·822	**·076**	·452	·624	·969	·661	·308
1867 ...	·824	·143	·514	·629	·058	·564	·494	·983	·667	·316
1868 ...	·836	·131	·344	·787	·053	·413	·640	·963	·673	·290
1869 ...	·814	·132	·463	·669	·046	·503	·543	·966	·659	·307
1870 ...	·797	·094	·418	·676	·015	·478	·537	·936	·637	·299
1871 ...	·805	·068	·466	·602	29·996	·521	·475	·932	·641	·291
1872 ..	·795	·067	515	·552	·980	·569	·411	·932	·640	·292
1873 ...	·811	·095	·440	·655	30·012	·513	·499	·943	·641	·302
1874 ...	·810	·102	·378	·724	·024	·445	·579	·975	·628	·347
1875 ...	·808	·080	·465	·615	·013	·500	·513	·938	·652	·286
1876 ...	·816	·091	·465	·626	·022	·542	·480	·957	·631	·326
1877 ...	·846	·108	·540	·568	·049	·600	·449	·976	·713	·263
1878 ...	·809	·106	·467	·639	·022	·517	·505	·953	·654	·299
1879 ...	·801	·080	·294	·786	·003	**·402**	·601	·924	·673	·251
1880 ...	·818	·103	·477	·626	·033	·561	·472	·975	·668	·307
1881 ...	·820	·120	·504	·616	·041	·540	·501	·963	·677	·287
1882 ...	·807	·140	·366	·774	·058	·433	·625	·965	·633	·332
1883 ...	·812	·132	·469	·663	·053	·545	·508	·989	·639	·350
1884 ...	·827	·136	·419	·717	·053	·472	·581	·993	·648	·345
1885 ...	·826	·125	·404	·721	·051	·470	·581	·987	·652	·335
1886 ...	·809	·132	·362	·770	·057	·461	·596	·947	·653	·294
1887 ...	·818	·130	·406	·724	·060	·466	·594	·935	·662	·273
1888 ...	·832	·130	·537	·593	·061	·585	·476	·975	·664	·311
1889 ...	·818	·096	·394	·702	·028	·475	·553	·970	·647	·323
1890 ...	·814	·094	·505	·589	·023	·552	·471	·947	·632	·315
1891 ...	·834	·128	·471	·657	·045	·522	·523	·960	·653	·307
1892 ...	·790	·084	·418	·666	·017	·492	·525	·968	·608	·360
1893 ...	·815	·081	·432	·649	·014	·518	·496	·958	·648	·310
1894 ...	·809	·094	·451	·643	·021	·498	·523	·945	·636	·309
1895 ...	·819	·105	·390	·715	·026	·436	·590	·936	·654	·282
Mean of 50 years ...	29·811									

TABLE 2.—Temperature of the Air.

1846–1895.

Year.	Annual Mean.	Individual hours.			Daily means.			Monthly means.		
		Maximum.	Minimum.	Extreme range.	Maximum.	Minimum.	Range.	Maximum	Minimum.	Range.
	°	°	°	°	°	°	°	°	°	°
1846 ...	**80·5**	98·8	63·8	35·0	88·4	72·6	15·8	86·7	76·4	10·3
1847 ...	79·0	94·2	**53·3**	40·9	86·5	**62·2**	24·3	83·9	73·7	10·2
1848 ...	79·8	98·0	57·0	41·0	86·7	67·1	19·6	84·6	75·1	9·5
1849 ..	79·6	96·5	58·5	38·0	86·6	65·9	20·7	85·2	73·3	11·9
1850 ...	79·9	97·0	60·0	37·0	87·8	68·1	19·7	84·4	72·4	12·0
1851 ...	79·5	93·3	57·3	36·0	86·7	65·6	21·1	84·6	72·2	12·4
1852 ...	80·2	95·4	57·4	38·0	88·3	66·7	21·6	86·3	71·9	14·4
1853 ...	80·5	96·4	58·6	37·8	89·4	67·0	22·4	86·9	71·6	15·3
1854 ...	80·6	98·4	63·0	35·4	89·4	71·3	18·1	86·9	75·0	11·9
1855 ...	80·7	95·3	60·0	35·3	88·5	69·2	19·3	86·0	74·7	11·3
1856 ...	80·5	94·6	63·0	31·6	88·1	72·6	15·5	86·1	75·4	10·7
1857 ...	79·9	**100·2**	63·0	37·2	87·6	70·9	16·7	86·1	73·9	12·2
1858 ...	80·1	94·9	60·8	34·1	88·0	69·0	19·0	86·2	73·3	12·9
1859 ...	80·2	98·4	62·0	36·4	88·0	69·7	18·3	85·2	74·2	11·0
1860 ...	80·0	93·7	59·6	34·1	88·1	68·3	19·8	85·0	72·3	12·7
1861 ...	79·3	97·0	62·5	34·5	87·6	70·6	17·0	85·2	74·4	10·8
1862 ...	80·6	94·0	61·4	32·6	87·8	69·6	18·2	85·8	72·9	12·9
1863 ...	79·8	95·0	60·2	34·8	87·9	67·3	20·6	86·0	74·3	11·7
1864 ...	79·9	94·0	60·7	33·3	87·6	68·9	18·7	84·4	71·3	13·1
1865 ...	81·0	96·0	66.1	29·9	**89·5**	73·2	16·3	**87·6**	77·0	10·6
1866 ...	78·3	91·8	56·6	35·2	86·3	65·3	21·0	82·7	71·8	10·9
1867 ...	78·8	92·6	61·8	30·8	87·4	70·0	17·4	84·7	73·1	11·6
1868 ...	79·1	92·5	62·2	30·3	85·9	69·4	16·5	84·5	72·9	11·6
1869 ..	79·9	92·4	63·3	29·1	86·4	72·2	14·2	84·1	75·3	8·8
1870 ...	79·0	92·7	62·9	29·8	86·3	68·9	17·4	83·7	73·6	10·1
1871 ...	80·1	93·3	66·1	27·2	86·7	70·6	16·1	85·6	74·9	10·7
1872 ...	78·9	93·3	60·4	32·9	86·7	68·1	18·6	84·1	71·7	12·4
1873 ...	78·9	93·2	55·2	38·0	87·7	65·4	22·3	84·0	72·1	11·9
1874 ...	78·3	93·0	60·9	32·1	85·8	66·7	19·1	83·7	**71·1**	12·6
1875 ...	79·3	91·2	59·1	32·1	86·8	66·3	20·5	83·8	72·2	11·6
1876 ...	79·3	91·1	65·8	25·3	86·6	71·3	15·3	84·4	74·9	9·5
1877 ...	80·3	91·3	63·2	28·1	87·1	69·9	17·2	84·0	74·4	9·6
1878 ...	80·1	94·8	62·8	32·0	87·4	69·6	17·8	85·1	73·3	11·8
1879 ...	78·6	96·5	65·4	31·1	87·5	70·6	16·9	82·9	73·1	9·8
1880 ...	79·5	91·9	60·4	31·5	86·1	67·6	18·5	84·5	73·0	11·5
1881 ...	80·0	92·0	67·1	24·9	86·5	73·5	13·0	85·1	76·1	9·0
1882 ...	79·1	92·1	65·1	27·0	85·6	71·7	13·9	83·6	74·9	8·7
1883 ...	78·8	90·9	62·8	28·1	86·3	69·4	16·9	84·2	72·8	11·4
1884 ...	78·8	91·9	63·1	28·8	86·4	68·9	17·5	83·5	71·9	11·6
1885 ...	79·2	91·8	62·1	29·7	87·3	68·7	18·6	84·3	72·3	12·0
1886 ...	79·5	95·4	59·5	35·9	87·4	67·4	20·0	85·0	73·5	11·5
1887 ...	78·7	92·2	56·9	35·3	85·8	67·0	18·8	84·2	72·6	11·6
1888 ...	80·1	93·8	65·7	28·1	86·6	71·2	15·4	84·1	74·1	10·0
1889 ...	79·6	92·1	65·7	26·4	87·4	72·7	14·7	85·4	74·6	10·8
1890 ...	79·3	91·1	66·9	24·2	86·1	72·1	14·0	83·9	75·1	8·8
1891 ...	79·5	90·8	60·3	30·5	86·8	67·3	19·5	84·9	73·5	11·4
1892 ...	79·9	93·9	64·4	29·5	89·0	70·4	18·6	85·7	75·5	10·2
1893 ...	78·9	92·1	59·8	32·3	86·0	68·1	17·9	83·6	72·1	11·5
1894 ...	79·6	90·4	65·1	25·3	86·7	71·9	14·8	84·6	75·1	9·5
1895 ...	79·6	92·3	62·0	30·3	86·6	69·1	17·5	84·1	73·2	10·9
Mean of 50 years. ...	79·6									

Table 3.—Pressure of Vapour.

1846—1895.

Year.	Annual Mean.	Individual hours.			Daily means.			Monthly means.		
		Maximum.	Minimum.	Extreme range.	Maximum.	Minimum.	Range.	Maximum.	Minimum.	Range.
	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.
1846 ...	0·809	1·116	0·318	0·798	1·022	0·478	0·544	0·961	0·612	0·349
1847 ...	·795	·099	·189	·910	0·985	**·259**	·726	·934	·606	·328
1848 ...	·803	·046	·303	·743	·987	·330	·657	·918	·629	·289
1849 ...	·796	**·214**	·280	·934	1·060	·351	·709	**·969**	·588	·381
1850 ...	·784	·076	·270	·806	0·983	·392	·591	·942	·566	·376
1851 ...	·782	·030	·236	·794	·988	·348	·640	·929	·555	·374
1852 ...	·769	·069	·265	·804	·961	·369	·592	·920	·508	·412
1853 ...	·765	·028	·247	·781	·974	·353	·621	·934	·511	·423
1854 ...	·795	·124	·198	·926	1·025	·337	·688	·946	·557	·389
1855 ...	·794	·110	·297	·813	·002	·439	·563	·947	·596	·351
1856 ...	·796	·076	·300	·776	0·977	·425	·552	·933	·625	·308
1857 ...	·792	·125	·321	·804	**1·067**	·475	·592	·933	·566	·367
1858 ...	·815	·139	·360	·779	·044	·479	·565	·968	·625	·343
1859 ...	·809	·155	·369	·786	·040	·439	·601	·957	·608	·349
1860 ...	·800	·088	·299	·789	·019	·405	·614	·956	·562	·394
1861 ...	·772	·066	·260	·806	0·982	·402	·580	·921	·565	·356
1862 ...	·778	·055	·304	·751	·983	·423	·560	·934	·553	·381
1863 ...	·759	·000	·267	·733	·927	·390	·537	·902	·577	·325
1864 ...	·748	·040	·219	·821	·948	·359	·589	·900	**·484**	416
1865 ...	·789	·107	·353	·754	·989	·488	·501	·930	·607	·323
1866 ...	·762	·089	·235	·854	·978	·336	·642	·932	·545	·387
1867 ...	·784	·046	·282	·764	·987	·428	·559	·947	·560	·387
1868 ...	·785	·091	**·128**	·963	1·023	·335	·688	·953	·583	·370
1869 ...	·787	·052	·272	·780	0·992	·433	·559	·930	·608	·322
1870 ...	·772	·044	·244	·800	·976	·432	·544	·915	·566	·349
1871 ...	·800	·051	·346	·705	·959	·474	·485	·915	·632	·283
1872 ...	·758	·091	·217	·874	·996	·348	·648	·925	·515	·410
1873 ...	·755	·055	·223	·832	1·005	·285	·720	·906	·532	·374
1874 ...	·743	·033	·232	·801	0·964	·353	·611	·892	·513	·379
1875 ...	·760	·031	·215	·816	·973	·321	·652	·911	·515	·396
1876 ...	·751	0·994	·340	·654	·956	·474	·482	·892	·584	·308
1877 ...	·788	1·022	·257	·765	·964	·349	·615	·916	·583	·333
1878 ...	·795	·100	·252	·848	·999	·383	·616	·921	·563	·358
1879 ...	·748	·049	·281	·768	1·009	·400	·609	·909	·552	·357
1880 ...	·767	·035	·262	·773	0·964	·379	·585	·891	·533	·358
1881 ...	·774	·014	·286	·728	·959	·417	·542	·904	·579	·325
1882 ...	·764	·047	·283	·764	1·007	·435	·572	·908	·597	·311
1883 ...	·758	·027	·297	·730	0·963	·388	·575	·921	·525	·396
1884 ...	·756	0·994	·330	·664	·938	·440	·498	·896	·544	·352
1885 ..	·769	1·129	·273	·856	1·013	·355	·658	·926	·536	·390
1886 ...	·780	·096	·194	·902	·048	·366	·682	·920	·570	·350
1887 ...	·759	·014	·193	·821	0·958	·303	·655	·882	·574	·308
1888 ...	·794	·067	·357	·710	·977	·412	·565	·931	·618	·313
1889 ...	·787	·050	·329	·721	1·001	·461	·540	·939	·599	·340
1890 ...	·771	·009	·337	·672	0·952	·478	·474	·907	·589	·318
1891 ...	·757	·029	·206	·823	·970	·309	·661	·919	·568	·351
1892 ...	·792	·050	·298	·752	·984	·452	·532	·923	·621	·302
1893 ...	·759	·015	·253	·762	·970	·373	·597	·899	·548	·351
1894 ...	·784	·087	·344	·743	·959	·485	·474	·929	·616	·313
1895 ...	·776	·030	·333	·697	·965	·420	·545	·923	·580	·343
Mean of 50 years ...	0·778									

TABLE 4.—Wind.

1846–1895.

Year.	Annual Mean Pressure.	Average Direction.	Absolute Maximum Pressure.	Maximum Mean Daily Pressure.	Maximum Mean Monthly Pressure.
	lb.		lb.	lb.	lb.
1846 ...	·44	NW	4·16	1·94	0·65
1847 ...	·39	NW	3·60	1·63	0·65
1848 ...	·32	NW	5·26	3·21	0·68
1849 ...	·25	NW	9·00	2·31	0·64
1850 ...	·2	WNW	15·00	1·60	0·37
1851 ...	·18	NW	8·00	3·00	0·49
1852 ...	·16	NW	10·70	1·00	0·39
1853 ...	·2	NW	7·00	1·40	0·51
1854 ...	·18	NW.	35·00	8·06	0·33
1855 ...	·24	NW	13·00	2·05	0·52
1856 ...	·20	NW	16·00	3·08	0·37
1857 ...	·21	NW	9·50	1·29	0·51
1858 ...	·26	NW	12·00	2·38	0·55
1859 ...	·33	NW	11·25	4·29	1·02
1860 ...	·29	WNW	14·00	2·01	0·48
1861 ...	·37	WNW	8·75	2·26	0·71
1862 ...	·41	NW	10·75	4·02	0·67
1863 ...	·38	WNW.	7·75	3·05	0·92
1864 ...	·32	*WNW	6·25	1·25	0·62
1865 ...	·31	*WNW	10·50	1·95	0·51

*From the year 1864 the average direction is replaced by resultant direction.

Year.	Annual Mean Velocity.	Mean Resultant Direction.	Maximum Hourly Mean Velocity.	Maximum Mean Daily Velocity.	Maximum Mean Monthly Velocity.
	Miles.		Miles.	Miles.	Miles.
1866 ...	14·36	W	58·7	46·2	22·5
1867 ...	12·4	WNW	41	32·1	19·4
1868 ...	12·5	WNW	50	39·5	19·9
1869 ...	12·4	WNW	59	38·5	20·7
1870 ...	11·8	WNW	41	31·5	19·5
1871 ...	12·6	WNW	48	32·1	21·3
1872 ...	12·2	WNW	46	32·3	19·8
1873 ...	12·5	WNW	43	30·0	23·0
1874 ..	11·9	WNW	47	36·5	19·6
1875 ...	12·1	WNW	45	33·5	21·0
1876 ...	12·7	WNW	43	30·7	22·7
1877 ...	11·7	WNW	43	33·0	18·7
1878 ...	11·6	WNW	47	30·7	15·7
1879 ...	12·4	WNW	56	39·5	17·2
1880 ...	12·0	WNW	34	30·8	19·7
1881 ...	12·3	WNW	40	31·6	20·5
1882 ...	11·8	WNW	53	34·2	20·3
1883 ...	12·2	WNW	45	31·8	20·4
1884 ...	12·1	WNW	36	29·0	18·6
1885 ...	12·4	WNW	56	41·1	18·4
1886 ...	11·7	WNW	48	35·2	16·9
1887 ...	12·0	WNW	44	30·2	20·6
1888 ...	12·0	WNW	50	27·3	19·9
1889 ...	11·5	WNW	59	39·8	17·2
1890 ...	12·1	WNW	40	26·4	20·4
1891 ...	12·0	WNW	41	33·2	18·1
1892 ...	11·0	W	48	31·6	19·0
1893 ...	11·1	WNW	39	30·0	14·6
1894 ...	10·9	WNW	42	34·1	17·5
1895 ...	11·1	WNW	44	30·7	17·3

Table 5.—Rainfall.

1846—1895.

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual Total.	Number of rainy days.	Maximum fall in one day.	Time of occurrence.
	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.		In.	
1846	...	...	...	...	...	26·41	33·19	6·65	6·65	1·03	...	...	73·93	104	5·16	16th July.
1847	0·90	0·02	...	0·31	1·40	37·56	16·45	8·68	5·68	0·28	5·53	...	76·00	120	12·54	11th June.
1848	...	...	...	0·59	5·67	39·98	13·90	7·37	2·32	5·84	0·19	...	75·86	96	8·14	14th June.
1849	0·34	...	...	...	...	23·41	50·99	12·66	26·13	0·75	0·61	..	114·89	100	6·35	25th July.
1850	...	...	...	..	...	14·80	20·15	5·39	4·77	4·89	0·25	...	50·25	103	4·61	17th July.
1851	...	...	...	...	0·52	24·50	47·02	20·03	3·89	0·04	0·07	...	96·07	89	6·51	25th August.
1852	...	...	0·01	...	0·30	21·76	22·17	11·16	12·67	0·19	...	1·01	69·27	100	7·09	22nd June.
1853	...	0·05	0·02	...	...	33·70	13·05	5·95	9·83	...	...	...	62·60	84	9·89	18th June.
1854	...	...	...	...	...	16·34	38·95	3·90	13·61	7·49	1·85	...	82·14	114	5·55	14th June.
1855	...	..	...	..	...	20·18	11·83	3·82	5·29	0·06	...	...	41·18	91	4·79	20th June.
1856	...	...	...	...	2·09	24·66	24·48	6·73	7·78	0·06	...	0·12	65·92	109	10·28	9th June.
1857	...	...	...	...	0·57	9·26	8·74	15·71	14·21	2·78	...	...	51·27	108	5·27	1st August.
1858	...	...	..	0·15	1·57	14·44	20·12	7·48	15·47	3·22	...	...	62·45	105	6·15	11th September.
1859	...	...	...	...	...	26·87	28·70	14·59	5·94	1·06	...	...	77·16	91	8·20	12th June.
1860	...	...	...	...	0·03	21·97	22·39	7·11	8·15	2·50	...	...	62·15	93	7·31	13th June.
1861	...	...	...	...	0·69	15·43	25·34	30·35	3·24	1·86	...	...	76·91	99	6·08	18th August.
1862	..	...	...	...	0·01	22·31	15·10	12·65	21·69	1·42	0·45	...	73·63	107	6·16	21st June.
1863	0·41	...	...	0·11	0·07	23·41	30·78	10·60	9·98	2·32	...	...	77·68	109	8·14	24th July.
1864	...	...	...	...	0·01	15·42	13·36	10·72	5·59	...	0·47	...	45·57	95	3·56	26th June.
1865	0·38	...	...	...	...	10·61	18·28	36·42	4·86	6·16	1·14	...	77·85	104	7·86	2nd July.
1866	...	0·11	...	...	...	13·47	40·34	20·34	3·44	0·74	...	...	78·44	98	7·63	11th July.
1867	...	...	...	...	...	8·70	29·39	22·21	6·80	5·07	0·13	...	62·30	110	5·41	16th July.
1868	...	...	0·01	...	...	13·52	20·43	20·29	7·11	0·14	0·02	...	62·12	107	10·23	9th August.
1869	...	...	...	...	0·03	26·22	23·89	15·24	22·56	3·55	0·05	0·12	91·66	102	15·31	27th June.
1870	...	...	0·03	0·02	...	21·73	26·43	6·27	7·08	4·65	...	...	66·21	109	4·71	18th June.
1871	2·22	...	...	...	1·25	8·91	9·96	8·95	6·01	0·25	2·97	0·06	40·58	107	4·64	31st August.
1872	...	...	...	...	0·06	24·43	24·84	9·49	16·59	1·07	...	...	76·48	98	9·23	12th September.
1873	...	0·05	...	...	0·51	20·36	16·98	23·96	7·77	0·07	...	...	69·70	101	6·23	24th August.
1874	...	...	...	...	0·05	18·68	41·24	11·14	11·05	0·02	...	...	82·18	103	4·48	21st July.
1875	0·47	0·05	...	...	...	23·97	15·14	11·95	31·51	...	...	...	83·09	97	8·14	5th September.
1876	...	...	...	...	0·01	12·97	23·69	8·66	4·71	...	...	...	50·04	83	7·59	26th July.
1877	0·23	0·51	0·02	...	...	34·61	10·75	10·78	6·60	6·39	...	...	69·89	99	14·60	19th June.
1878	0·03	...	...	0·02	0·03	20·49	47·64	20·02	16·90	4·17	2·63	...	111·93	113	5·55	5th July.
1879	...	...	0·03	...	5·23	16·56	11·21	22·36	5·61	0·40	...	...	61·40	111	3·78	30th July.
1880	...	0·01	0·02	...	...	21·48	18·37	4·08	22·80	1·18	...	...	67·94	109	8·20	2nd July.
1881	...	...	0·04	...	0·36	15·29	29·47	19·06	4·56	4·17	0·09	...	73·04	113	11·30	3rd August.
1882	...	0·04	0·02	0·08	0·02	27·54	26·94	3·36	10·08	1·12	0·03	...	69·23	105	10·18	3rd June.
1883	0·12	...	...	...	0·33	13·65	39·88	12·57	12·37	10·40	0·86	...	90·18	123	6·85	13th July.
1884	0·03	...	...	...	..	13·25	25·87	15·29	17·04	2·22	0·60	1·14	75·44	110	7·37	13th July.
1885	...	...	...	...	0·02	5·11	21·81	25·42	12·01	3·54	...	...	67·91	113	10·29	15th August.
1886	...	...	...	0·01	0·96	43·45	35·79	10·69	6·54	1·69	0·61	...	99·74	110	16·10	18th June.
1887	...	...	...	0·02	0·09	24·07	30·98	17·59	18·23	2·79	1·02	0·16	94·95	112	7·84	10th September.
1888	1·85	0·02	0·10	...	...	15·76	22·47	11·43	4·92	0·11	1·16	..	57·82	107	4·66	14th July.
1889	...	...	..	...	0·67	19·89	30·45	10·32	2·71	3·80	...	...	67·84	103	4·04	8th July.
1890	...	...	...	0·01	0·06	24·55	21·54	10·61	6·45	0·58	1·25	0·13	65·18	116	4·61	19th June.
1891	...	...	0·20	...	...	13·99	32·48	6·94	22·53	1·04	...	...	77·18	100	5·82	1st September.
1892	...	...	...	...	0·11	13·30	23·86	36·56	18·73	1·89	0·67	...	95·42	114	5·43	31st August.
1893	...	0·14	...	0·02	6·30	21·47	16·14	13·55	7·54	0·45	1·63	...	67·24	124	4·97	20th June.
1894	0·22	..	0·06	0·01	...	16·87	26·16	8·40	12·04	3·08	...	0·01	66·85	124	4·77	21st July.
1895	...	0·07	...	...	0·08	17·84	18·04	15·97	11·91	3·62	0·06	...	67·59	109	6·82	7th September.
Average of 50 years.	0·13	0·02	0·01	0·03	0·58	20·30	24·74	13·23	10·65	2·20	0·49	0·05	72·44	105	...	

TABLE 6.—Absolute Magnetical Observations, 1846—1895.

Year.	Declination.	Horizontal force.	Dip.	Year.	Declination.	Horizontal force.	Dip.
	′ ″	M.m.—m.g.—S. units.	° ′		′ ″	M.m.—m.g.—S. units.	° ′
1846	13 18	3·6541	18 37·7	1871	49 38	3·7245	19 8·8
1847	14 1	3·6633	18 17·9	1872	51 34	3·7256	19 13·9
1848	14 23	3·6610	18 8·6	1873	52 38	3·7274	19 14·7
1849	14 40	3·6665	18 47·9	1874	53 26	3·7301	19 14·6
1850	15 51	3·6734	18 55·5	1875	54 26	3·7323	19 13·3
1851	16 47	3·6743	19 1·5	1876	55 3	3·7347	19 11·8
1852	16 45	3·6871	18 57·4	1877	55 28	3·7353	19 20·2
1853	18 8	3·6877	19 11·4	1878	56 0	3·7367	19 20·0
1854	18 5	3·6882	18 56·0	1879	56 26	3·7382	19 22·2
1855	19 20	3·6875	18 56·9	1880	56 21	3·7380	19 21·6
1856	18 55	3·6960	19 4·7	1881	55 55	3·7374	19 20·4 / 19 43·0 *
1857	19 17	3·7003	19 4·0	1882	55 55	3·7359	19 42·8
1858	19 48	3·7008	19 17·9	1883	55 55	3·7389	19 43·4
1859	21 25	3·7113	19 4·5	1884	54 33	3·7437	19 45·0
1860	23 57	3·7080	19 5·2	1885	53 52	3·7427	19 46·3
1861	27 7	3·7142	19 3·3	1886	52 34	3·7415	19 45·9
1862	30 31	3·7137	19 7·1	1887	51 13	3·7421	19 46·9
1863	33 57	3·7186	19 10·7	1888	50 4	3·7436	20 10·6
1864	36 27	3·7277	19 19·9	1889	48 13	3·7438	20 18·9
1865	40 4	3·7047	19 23·5	1890	46 22	3·7445	20 23·7
1866	40 40	3·7116	19 12·8	1891	44 26	3·7441	20 28·9
1867	42 1	3·7167	19 4·5	1892	42 40	3·7424	20 33·3
1868	43 57	3·7170	19 3·9	1893	40 19	3·7437	20 35·1
1869	46 8	3·7186	19 5·8	1894	38 34	3·7426	20 40·7
1870	47 47	3·7220	19 7·1	1895	36 9	3·7444	20 48·5

* Upper entry denotes the average dip from January to September and the lower for October to December.

MAGNETICAL AND METEOROLOGICAL OBSERVATIONS

MADE AT THE

GOVERNMENT OBSERVATORY, BOMBAY,

1896.

WITH AN APPENDIX.

MAGNETICAL AND METEOROLOGICAL OBSERVATIONS

MADE AT THE

GOVERNMENT OBSERVATORY, BOMBAY,

1896,

UNDER THE DIRECTION OF

N. A. F. MOOS, Esq., B.Sc. (Edin.), F.R.S.E., &c.

WITH AN APPENDIX.

LIBRARY OF THE BOMBAY BRANCH OF THE ROYAL ASIATIC SOCIETY.

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TABLE OF CONTENTS.

PAGE.

INTRODUCTION TO THE METEOROLOGICAL AND MAGNETICAL OBSERVATIONS, 1896.

Thirty-fifth number of series ... ... i.
Local situation and geographical position, &c., of the Observatory ... ... id.
Directorship of the Observatory ... ... id.
PERSONAL ESTABLISHMENT AND ARRANGEMENTS, 1896 ... ... id.
Distribution of duties ... ... ii.
SYSTEM OF OBSERVATION ... ... iii.
Daily routine operations ... ... id.
Weekly routine operations ... ... iv.
Monthly observations ... ... id.
Quarterly, half-yearly and yearly observations... ... ... id.
General description of the Magnetical and Meteorological Instruments, their adjustments and the process of reduction ... ... id.
(*a*) METEOROLOGICAL INSTRUMENTS.
Standard Barometer, description of... ... ... id.
Error in setting the zero position of the scale, and change of method of observation ... ... v.
Corrections for error of verniers ... ... id.
Corrections applied to the observed readings ... ... id.
Comparison with the Kew Standard Barometer ... ... vi.
Barograph ... ... id.
Dry and Wet-bulb Thermometers... ... ... id.
Standard Dry-bulb ... ... id.
Standard Wet-bulb ... ... vii.
Photographic Dry-bulb and Wet-bulb ... ... id.
Ground Thermometers ... ... id.
Robinson Beckley Anemograph, description of... ... ... viii.
Tabulation of anemograms ... ... ix.
Method of reduction ... ... id.
Rain Gauges ... ... x.
Newman's Rain Gauge ... ... id.
Photographic Rain Gauge ... ... id.
New syphon of modified form ... ... id.
Constants for converting syphon discharges into inches of rainfall ... xi.
Measurement and distribution of syphon discharges ... ... id.
Determination of scale of rainfall ordinates ... ... id.
(*b*) MAGNETICAL INSTRUMENTS, 1896 ... ... xii.
Kew pattern Unifilar Magnetometer ... ... id.
Kew Dip Circle ... ... id.
PROCESSES OF REDUCTION AND DESCRIPTION OF THE TABLES OF METEOROLOGICAL RESULTS, 1896.
Pressure of Vapour and additional capacity of the Air ... ... xiii.
Table I.—Regnault's values of the pressure of vapour at different temperatures ... id.
Barometric pressure ... ... id.
Temperature of the Air, &c. ... ... id.
Monthly and annual Range of Variation of Meteorological Elements ... ... xiv.
NOTES ON INSTRUMENTAL CHANGES AND ON ALL IRREGULARITIES OR DEPARTURES FROM THE ROUTINE OF OBSERVATION OR REDUCTION, 1896 ... ... id.
Robinson-Beckley's Anemograph ... ... id.
Barograph ... ... xv.
Thermograph Dry-bulb... ... ... id.
Thermograph Wet-bulb ... ... id.
Self-registering Rain Gauge ... ... id.

Tables of Results derived from the Continuous Registrations of Automatic Meteorological Instruments and from Meteorological Observations, 1896.

	1896. Table.	Page.
Daily Means of: Barometric Pressure	I	2
Daily Means of: Temperature of the Air	II	3
Daily Means of: Pressure of Vapour	III	4
Daily Means of: Additional Capacity of the Air	IV	5
Individual observations in each Month of the Year, which showed the greatest and the least values of the following elements, *viz.*, Height of Barometer, corrected for Temperature; Temperature of Air; Pressure of Vapour; and Additional Capacity of Air	V	6
Daily: Total Fall of Rain (in inches) as measured by F. Chambers's Self-registering Gauge, the funnel of which is 28 feet above the ground	VI	7
Mean Velocities of the North or South and East or West Components of the Winds which blew on each Day of the Year	VII	8
Mean Velocity of the Wind, in miles per hour, without regard to the direction from which it blew for each day of Bombay Civil Time; also the Mean Monthly Velocity, and its Variation from the Mean of the Year	VIII	9
Sums of the Velocities, and the Mean Velocities, in miles per hour, of the Winds which blew in each Month, from each of the sixteen Principal Directions; and also the number of observations which those sums comprise; the latter numbers indicating the Relative Frequency of the same Wind (as to direction) in the several months, and of different Winds during the same month	IX	10

Tables of Results derived from the Meteorological Observations made daily at 6, 10, 14, 16 and 22 hours, 1896.

	1896. Table.	Page.
Monthly Mean Temperature of the Ground, and its Annual Variation, at the respective depths of 1, 9, 20, 60 and 132 inches below the surface	X	12
Extent of Cloudy Sky—mean of estimations made at 6, 10, 14, 16 and 22 hours daily, the whole sky being reckoned as 10	XI	13
Daily: Total Fall of Rain (in inches) as measured by Newman's Gauge, placed 4½ feet above the ground	XII	14
Five-Day Means, 1896	XIII	15

Tables of Results of Absolute Magnetical Observations, 1896.

	1896. Table.	Page.
Observations of Vibration and Deflection, taken with the Kew Unifilar Magnetometer (No. 23, by Elliot Brothers), for the determination of Absolute Horizontal Force	I	(3)
Observations of Absolute Declination	II	(6)
Observations of Inclination, taken with Barrow's Dip Circle, with Microscopes, No. 49 and two 3½-inch Needles	III	(7)
Supplementary Observations of Inclination, taken with Barrow's Dip Circle, with Microscopes, No. 49 and two 3½-inch Needles	III *a*	(10)

Appendix.

	Page.
Part A.—A short note on the disturbance of the Magnetical and Meteorological Intruments at the Colába Observatory during the earthquake of 12th June 1897	[1]
Part B.—Magnetical Observations, Declination, 1894, 1895, 1896	[9]
Part C.—Dines' Pressure Tube Anemometer	[15]
Part D.—Adjustment of Grubb's Declinometer	[21]
Part E.—Fifty years of Grubb's Declinometer and the Declination at Bombay	[37]

INTRODUCTION

TO THE

METEOROLOGICAL AND MAGNETICAL OBSERVATIONS,

1896.

The present volume—the thirty-fifth of its kind—extends the record of Magnetical and Meteorological Observations at the Government Observatory, Bombay, to a period of fifty-one years.

(2) *Local Situation of the Observatory, &c.* The Observatory is located at the extreme end of a narrow and somewhat rising strip of land called Colába, running about 2 miles south-west from the Fort of Bombay, and separating the Harbour from Back Bay. The mean level of the Observatory compound is 32 feet above the mean level of the sea at Colába. Basaltic traps with their intertrappean beds, which constitute more or less the basis of formation of the whole surrounding coast, crop up at various places through the red sandy soil characteristic of the hills in the vicinity. The nearest elevated ground is Malabár Hill lying northwards at a distance of about 4 miles on the opposite side of the Bay, while that which subtends the largest vertical angle (but less than 1° 7′) as seen from this Observatory, is the southern hill of the island of Karanja situated east-south-east at a distance of about 8 miles across the Harbour. Since the average gradient from Bombay to the Western Ghâts is a little more than 1 in 100, the peculiar situation of the Observatory must influence but little the winds that reach Bombay from over the sea, which is the prevalent direction, and those blowing from landward from the Ghâts and beyond.

The exact geographical position of the Observatory is

Latitude 18° 53′ 45″ North.
Longitude 72° 48′ 56″ East.

The buildings concerned with the production of the observations recorded herein are, (1) the Astronomical Observatory and the Anemometer Tower, with a western wing, the greater part of which serves as a computing room, whilst the remainder is partitioned off for a photographic operating room; (2) the Magnetical Observatory with the adjoining Electrometer Tower; (3) the underground Magnetograph Room; and (4) the Thermograph Shed, enclosing the thermograph room; to which may be added the old thermometer shed.

(3) *Directorship of the Observatory.*—The observations of January and February were taken under the direction of the late Mr. Charles Chambers, F.R.S., and those for the rest of the year under that of Mr. N. A. F. Moos, B.Sc. (Edin.), F.R.S.E., &c.

(4) Personal establishment and arrangement, 1896—

MAGNETICAL AND METEOROLOGICAL DEPARTMENTS.

The establishment of Assistants in the Magnetical and Meteorological Departments of the Observatory consisted of the following persons :—

First Assistant	... Vinayak Narayan Nene—Fellow of the Bombay University.
Second Assistant	... Ganesh Sadashiv Joshi—Matriculated.
First Observer	... Shitaram Vithal Benderkar.
Second Observer	... Vithal Govind Ganekar—P. S. Certificate.
Third Observer	... Narayan Sakharam Kelkar—P. S. Certificate.
Computer	... Laxuman Balwant Chaphekar—School Final Examination.

ASTRONOMICAL DEPARTMENT.

First Assistant	... Parsharam Laxuman Datar.
Second Assistant	... Damodar Vaman Sathaye. Matriculated.

Vacancies caused by absence on leave of permanent employes were filled on different occasions by Bhalchundra Krishna Fagre.

(5) The duties of the establishment are distributed in the following manner :—

The First Assistants are charged with the determination of values of instrumental constants and the more delicate observations requiring skill and long experience, and they generally control and superintend the whole of the work of their respective departments.

Upon the Second Assistant, Magnetical Department, devolves mostly the photographic operations. He is also responsible for all the photographic instruments which require constant and vigilant attention. The anemograph and meteorological work generally are attended to by the Second Assistant, Astronomical Department. The routine magnetical and meteorological observations are in general made by the observers, including the computer, who are made to take up the work by rotation. Amongst the duties of the observers are included the tabulation of all photograms, calculation and reduction of meteorological and magnetical elements, preparation of various meteorological and other returns, the calculation of daily averages and the writing out of the monthly abstracts. These latter consist of tables having the days of the month marked in numerical order in the first column and the hours of the day in order at the head of the columns, and there is one for each magnetical or meteorological element observed. In no case are the tabulations and reductions allowed to run into arrears unless very urgent special work is on hand. All observers attend the computing office when not actually engaged on observing duty. The Second Assistant, Astronomical Department, and Third Observer Narayan Sakharam Kelkar are entrusted with the absolute magnetic observations. Although every man is delegated with duties which he is most competent to perform, precautions are taken to keep some of the observers fully instructed in the different operations to provide for the occasional absence of any member of the establishment. All computing operations are systematically performed by one computer and checked by a repetition of the operation by another. Residing accommodation is provided for all the members of the establishment on the Observatory premises. On Sundays and general holidays all observers are set free except 3, one being kept on observing duty, one in charge of photographic instruments and one in charge of astronomical duties. The following are the initials of the members of the staff, which the respective observers attach to the several observations made by them :—

Name.	Initial.
Vinayak Narayan Nene	V. N.
Ganesh Sadashiv Joshi	G. S. J.
Shitaram Vithal Bendarkar	S.
Vithal Govind Ghanekar	V. G. G.
Narayan Sakharam Kelkar	N.
Luxuman Balwant Chaphekar	L.
Parsharam Luxuman Datar...	P.
Damodar Vaman Satbaye	D.
Bhalchundra Krishna Fagre	B. C.

(6) System of Observation.

(a) *Daily routine operations.*

Magnetical and meteorological observations are taken every day including Sundays at the hours 6, 10, 14, 16 and 22: the day commencing at midnight, Bombay (Colába), is reckoned from 0 to 24. The time of observation of each element is fixed and the observations are registered with strict punctuality as follows:—

From 5^m to the hour to 2^m after the hour.	Extent and description of clouds, state of the weather, occasional phenomena, and direction of the wind.
At 2^m after the hour.	Thermograph standard thermometer, dry bulb.
	Do. do. wet bulb.
„ 3 „ „ „	Newman's rain gauge (in wet season).
From 5 to 7 „ „ „	Thermometer in ground 1 inch deep.
	Do. do. 9 inches deep.
„ 7 to 9 „ „ „	Newman's standard barometer No. 58 and attached thermometer.
	Do. do. No. 48 and do.
At 12 „ „ „	Grubb's declination magnetometer.
„ 14 „ „ „	Grubb's horizontal force magnetometer and its thermometer.
„ 16 „ „ „	Vertical force magnetograph No. 2 and its thermometer.
„ 17 „ „ „	Vertical force magnetograph No. 1 and its thermometer.
„ 18 „ „ „	Declination magnetograph.
„ 19 „ „ „	Horizontal force magnetograph and its thermometer.
„ 20 „ „ „	Thermometer attached to barograph.

The maximum and minimum thermometers in the thermometer shed, as also the solar radiation thermometer, are read twice daily at 8 and 16 hours.

Observations made once daily include readings of (1) the vacuum gauges of the magnetographs, (2) the maximum and minimum thermometers in magnetograph room, (3) the ground thermometers 20, 60 and 132 inches deep, and (4) nocturnal radiation thermometer. (1) and (2) are read at 10 hours—the maximum and minimum thermometers being reset immediately thereafter, (3) the ground thermometers are read at 14 hours, and (4) the nocturnal radiation thermometer read at 8 hours. Newman's rain gauge is read daily at midnight during the monsoon months, as are also the discharges of the syphon of the self-registering pluviograph once or oftener as required. The electric clock is duly regulated by comparison thrice daily with the sidereal clock. Government chronometers belonging to the Royal Indian Marine and Royal Navy in store at the Observatory and those received from merchant ships in harbour are wound

daily or as required, and comparisons with a correct clock are made with sufficient frequency to render the instrument always ready for issue at call with well-determined rates.

(b) Weekly routine Observations.

Double sets of observations of vibration and deflection are made with the unifilar magnetometer every Wednesday for the determination of absolute horizontal force. The same instrument is used every Thursday for the determination of the declination. Observation for magnetic dip are made four times in a week—double sets on every Tuesday and Friday. Transit observations of stars for the determination of time and the errors and rate of the sidereal clock are made on Mondays, Wednesdays and Fridays in the dry months of the year. During the monsoon months no opportunity is lost for observing either the sun or the stars whenever visible.

(c) Monthly Observations.

Regular deflection observations for the two vertical force magnetographs are made with deflector on North side only at 2·5 feet position about the middle of every month between 18^h and 24^h; the deflector used being tested on the Electrometer Tower the day following the former observations.

The magnets of Grubb's declination and Grubb's horizontal force magnetometers are vibrated through a large arc (but less than 1°) about the 20th of every month, and the variation of its accuracy of return to the original position is carefully recorded.

(d) Quarterly, Half-yearly and Yearly Observations.

Once every quarter the weekly intensity observations are supplemented by observation of the magnet with its inertia cylinder.

Once every six months the usual monthly deflection observations of vertical force magnetographs Nos. 1 and 2 are elaborated with deflector on both North and South sides.

Once every year the same series of observations are repeated for the vertical force and horizontal force magnetographs with deflector at various distances on each side of the magnet.

(7) GENERAL DESCRIPTION OF THE MAGNETICAL AND METEOROLOGICAL INSTRUMENTS, THEIR ADJUSTMENTS AND THE PROCESS OF REDUCTION.

The following details show the special circumstances in connection with the condition, situation and adjustments of the various instruments, as also the habits of the observers and their routine processes of reduction, to enable the reader to form an independent judgment as to the reliableness of the observations and the degree of precision attained in the results.

(a) Meteorological Instruments.

Standard Barometer.—The barometer mounted on the eastern wall of the magnetical observatory a few feet from the north-east corner of the room is Newman No. 58 and is the same which has been in uninterrupted use since the establishment of the Observatory. Its tube is 0·53 inch in diameter. The cistern, which is of glass, is 37 feet above the mean sea level at Colába. The brass scale is moveable and terminates at the lower end in a point of ivory which for every observation is set so as just to meet its reflected image as seen in the mercury. The scale is primarily divided to 0·05 inch and by means of vernier, 0·002 inch can be read off. To the moving vernier are attached two small brass plates with two lower edges before and behind the tube. The setting of the instrument consists in raising or lowering the vernier until the

edges of the brass plates appear just to cut tangentially the convex surface of the mercury in the barometer tube, the line of sight being so regulated in height as to coincide with the edges. A thermometer with a cylindrical bulb dips into the cistern and was in use up to 1884, but in an investigation described in "Bombay Magnetical and Meteorological Observations, 1871 to 1878" it was discovered that the readings of the thermometer, as measuring the temperature of mercurial column, were considerably erroneous and the use of the thermometer was discontinued, and from the beginning of 1885 a thermometer by Murray and Heath, No. 2, divided to half degrees with its bulb immersed in a column of mercury held in a glass tube of nearly the same diameter as that of the barometer tube, was fixed to one side of the barometer, and readings of this thermometer have been used since 1885·0. The error of the attached thermometer varies by about a quarter of a degree within the annual range of the temperature of the barometer, and in adopting a mean error throughout, small pressure corrections of ± ·0003 have been disregarded.

The barometer was lifted down in 1866 and the mercury carefully run up to the top of the tube when it gave the sharp metallic click that is indicative of a good vacuum. It was replaced carefully in its position, the tube, &c., being kept in proper adjustment to verticality. The barometer is of the particular class, a description of which occurs at page 56 of the "Report of the Committee of Physics of the Royal Society, 1840" and therefore the scale of the barometer is laid off from the zero point from an authentic standard.

Since 1841, the year it was first mounted, there has been a gradual accumulation of scum on the surface of the mercury in the cistern, and the glass cistern became more and more opaque until the setting operation of the ivory zero point of the scale became a matter of difficulty and some uncertainty. For this reason the usual method adopted as described was changed on the 22nd May 1866. On that day the zero ivory point of the scale was set *once for all* and the setting screw removed, and suitable corrections for capacity were thenceforward applied to the readings. These were taken from the following formula :—

$$\text{Capacity correction} = \cdot 04321\ (h_0 - 29\cdot 943)$$

h_0 represents the uncorrected reading

data for the construction of which will be found in "Bombay Magnetical and Meteorological Observations, 1865—70."

As the fluctuation of the barometer reading from its mean value very rarely reaches ·4 inch, requiring a correction of ·017 inch, it seems very improbable that an error of so much as ·001 inch even occurs from any inaccuracy in the adopted values of the relative capacities of the tube and the cistern. Since the change was effected, the comparability of the observations for showing variations is on that account throughout much better secured.

The depression of mercury due to capillary action in a tube of ·53 inch diameter being small, no correction is applied on this account.

On 30th July 1875 it was discovered that the vernier scale of the barometer was short by ·002 inch. To correct the errors arising from this fault, instructions were issued to note the positions of coincidences at ·000 and ·050 of the vernier scale with the scale of the barometer and also the non-coincidences at the above scales when the barometer reading was in exact half-tenths of an inch. It became then an easy matter to construct a table of corrections and to apply them for all positions of the vernier. These corrections have throughout been applied since then.

The barometer is read daily including Sundays at 7^m after the hours of observation—6, 10, 14, 16 and 22. Each reading is corrected by the application of the

temperature correction—reducing the temperature of mercury column to 32° F. and that of the brass scale to 62° F. Another correction is applied to remove the error of discontinuity due to change of thermometer. The first correction is made by means of Table II of the Report of Committee of Physics of the Royal Society, the last by a constant reduction of the corrected pressure by ·002 inch. The considerations on which the last correction is based, are as follow:—(1) the tabulations of the barograph are known to exhibit correctly the diurnal variations of barometric pressure, free from any sensible influence of variations of the temperature of that instrument;* (2) the mean of twenty-four hourly barograph tabulations on any day is taken to correspond to the mean of the same twenty-four hourly pressures observed with Newman's barometer No. 58 and corrected for the temperatures indicated by the old attached thermometer; (3) it does not follow that the mean of the tabulations for the five observation hours (6, 10, 14, 16 and 22) will then correspond exactly to the mean of the observed pressures for the same hours, because the old thermometer does not indicate precisely the actual variations of temperature of the mercurial column: in fact the latter mean pressure was, on the average of all the observation days of the year 1872, ·0008 inch in excess of the former mean pressure; (4) nevertheless the correspondence for the five observation hours was adopted as near enough to identity with the correspondence for the twenty-four hours, and the recorded mean pressures of the years 1873 to 1884 will thus be ·0008 inch in excess of those of the years before 1873; (5) the old attached thermometer and the thermometer No. 2 by Murray and Heath were read together at the five observation hours throughout the year 1883, and the average excess of the former reading over the latter was found to be 0°·62; (6) hence to make the pressures reduced for the readings of Murray and Heath No. 2 correspond to those reduced for the readings of the old thermometer the former pressures must be decreased by ·0027 × 0·62 = ·0017, or—as the pressures are read and calculated only to thousandths of an inch—by ·002 inch. Thus taking the period before 1873·0 as a standard period, the recorded annual mean pressures of the years 1873 to 1884 will be ·0008 inch too high, and those of 1885 and later years ·0005 inch [= —·0020 + ·0017 + ·0008] too high.

Indirect comparisons of the barometer have been made with the Kew standard by means of two mountain barometers by Negretti and Zambra, numbered 705 and 711, when they were both found (in July 1876) to read ·011 inch higher than the Observatory standard. In England, however, they had been found to read ·007 and ·006 respectively higher than the Kew standard. Hence on an average the Observatory standard barometer read ·004 below the Kew standard. It happens that this is exactly the average amount by which the readings of Newman's barometer have been over reduced for temperature (*vide* Introduction to Bombay Magnetical and Meteorological Observations, 1871-78, paragraph 72).

Barograph.—The photographic barometer stands separate on two pillars in the magnetograph room. It was supplied through the Kew Committee of the British Association after being tested at the Kew Observatory, and is similar in construction to those adopted by the Meteorological Committee of the Royal Society for the seven observatories established by them in the United Kingdom in the year 1867. A detailed account of the instrument and its particulars and adjustment is given in the "Bombay Magnetical and Meteorological Observations, 1871 to 1878, page xvi to xlvi."

Dry and Wet Bulb Thermometers.

Standard Dry Bulb.—The thermometer is by Casella and marked No. 401: it is a mercurial thermometer, with a cylindrical bulb 3·7 inches long and

* The data for the construction of this formula will be found in the "Bombay Magnetical and Meteorological Observations, 1865—70," Introduction, pp. x, xi.

about 0·37 inch in diameter. The stem is graduated and divided in degrees: the range is from 0° to 120°, measuring 12·36 inches; and the bulb is freely exposed to the air. It is placed in the cage of the thermograph shed about 5 inches from and similarly exposed as the thermometer which records photographically.

Standard Wet Bulb:—This is also a mercurial thermometer by Casella No. 402 and has a cylindrcial bulb 3·7 inches long and 0·37 inch in diameter. The thermometer is graduated on its stem and is divided to degrees with a range from − 10° to +120°, measuring 13·03 inches. The bulb is covered with muslin, and is kept moist by capillary action of a bundle of fine cotton threads immersed in a small vessel of water near the thermometer bulb, and passing loosely round the thermometer stem just over the bulb. The same vessel of water supplies the evaporating fluid to the photographic wet bulb placed about 3 inches distant.

The errors of the above standard thermometers have been carefully found and corrections duly applied. The errors were determined by a Kew standard (No. 368) thermometer in February and March 1875, at fourteen points ranging between 32° and 102°, and the readings were found to be within 0°·1 of the truth. On 20th December 1877, the errors of the freezing points were also tested, showing no noticeable change (*vide* paragraph 53, Table 10 of the Introduction to the Bombay Magnetical and Meteorological Observations, 1871 to 1878).

Photographic Dry Bulb and Wet Bulb.—The height of the bulbs of the thermometers of the thermograph above the ground is 10 feet. The cage is placed on one of the most exposed parts of the Observatory grounds and away from any building; it is, however, screened, as well as the thermograph room in which the recording apparatus is placed, by a roomy shed with a planked roof that is everywhere 2 feet above the roofs of the cage and room: the sides of the shed are of the louvre construction on an enlarged scale, with double sheets of zinc enclosing a thick layer of felt substituted for the wooden laths, and with a vertical distance from lath to lath of one foot: the lowermost two feet of the sides are guarded simply by horizontal iron rods: the roof of the shed is covered with thick felt and then with strong canvas, and the whole of the exterior—sides and roof—is painted or limewashed white.

Ground Thermometers.

Thermometers with their bulbs at the respective depths below the surface of the ground of 1, 9, 20, 60 and 132 inches are regularly observed, the two former five times a day and the three latter once a day at 14 hours. They are all by Newman, of London, and are divided on brass scales, and the value of one division, approximate range of part of scale exposed above ground, and lengths of that part and of one average degree are shown below for each thermometer:—

Depth of Bulb.	Divided to	Approximate Range of exposed part of Scale.	Length of that Range.	Average length of 1°.
Inch.			Inches.	Inch.
1	1°	30° to 145°	8·19	·071
9	0°·2	70° to 115°	5·20	·116
20	1°	35° to 160°	6·73	·054
60	1°	35° to 160°	6·81	·054
132	1°	50° to 140°	6·44	·072

The 1-inch and 9-inch thermometers are on flat brass scale frames, which lie against wooden posts in the ground, and they have their bulbs in contact with the loose red earth which fills the holes in which they are placed; the

20-inch, 60-inch, and 132-inch thermometers have their lower parts enclosed in brass tubes with ends curving off to a point, and the upper parts are in wooden box frames, to which the brass scales are fixed. The reason why only one observation is made daily of the three deeper thermometers is, that it had been found by hourly observations in 1849, 1850 and 1851, that no appreciable diurnal variation of temperature reached the depth of 20 inches.

The errors of graduation of the ground thermometers are unknown.

Robinson-Beckley Anemograph.—From the establishment of the Observatory till December 1865 a rough pressure anemometer was in use. This was replaced by a small anemometer by Robinson which remained in use up to June 1867. From the beginning of the month of June 1867 was brought into use an anemograph of the kind designed by Robinson, with improvements by Robert Beckley, and it remains in action to this day. It was made by Mr. R. W. Munro, and was supplied through the Kew Committee of the British Association, after being tested at the Kew Observatory. In this instrument the arrangements for the registration both of movement and direction of the wind are mounted on one shaft, and the registrations are made on a single sheet of paper, which is changed daily. The essential part of the apparatus for measuring the movement is a vertical spindle, to which cross arms are attached at the top, carrying four hemispherical cups of copper. The cups are attached to their several arms, so that, looking from the central axis, their convex sides are seen turned to the right hand, and the wind, acting with greater effect upon the concave than on the convex sides of the cups, causes the system to rotate in a right-handed direction. It is the number of these rotations, 140 of which are reckoned to a mile of movement of the wind, that tells us how fast the wind has been blowing; and the number is reduced, by means of wheelwork, 7,000 times before reaching a small cylinder, carrying a brass spiral pencil that traces the movement on the registering paper; this latter is metallic paper of the kind used for pocket-books, and is wrapped round a brass cylinder, which is kept rotating by clockwork, and as the paper passes under the spiral pencil, which presses slightly upon it, the black movement trace is received upon it. The wind vane, which consists of a pair of windmill vanes with connecting spindle having an endless screw in the middle, and gearing into a fixed horizontal toothed wheel, is attached to a tube that surrounds the lower part of the vertical movement spindle; to the bottom of the tube is fixed a toothed wheel, which, in communication with other such wheels, conveys the motion of the vane *unchanged* to a small cylinder with spiral pencil, which traces the changes of direction on the register; and it is so arranged that the movement and direction are traced on parallel strips or bands of the same sheet of paper which is changed daily at 10 hours. The heavy parts of the instrument—the direction vane and appendages, and two long brass tubes which connect the instrument proper with the recording apparatus—are supported on friction balls which run in grooves partially filled with oil, thus reducing the friction to a minimum. The instrument is erected on the old Time Ball Tower, at a height of 53 feet above the ground, and 95 feet above the mean sea level, over a platform 12 feet in diameter, which is designed to give ready access to the instrument, and to protect it from irregular currents of wind, glancing from the convex surface of the dome; and it is supported outside by a fixed cast-iron standard, to which is attached, at the top, the toothed wheel, into which the endless screw of the spindle connecting the windmill vanes gears. The centres of each pair of opposite hemispherical cups are four feet apart, and three and a half feet above the platform, and the diameter of the cups is nine inches. The diameter of the vanes is 15 inches, and the breadth of the fans four inches. The register form is printed in red, with lines dividing its length into hour spaces; and its breadth, on the movement side, into five spaces, each representing 10 miles of movement of the wind, and numbered from 0 to 50

miles; and on the direction side into spaces corresponding to 11¼ degrees on each side of the 16 principal directions N.N.E., N.E., &c.....N.N.W., N., which spaces are numbered consecutively 1, 2, &c.....15, 16.*

Tabulation of Anemograms.—Numerical tabulations have been made of the movement and direction of the wind during the interval between every two successive hours in the following manner:—the number of miles indicated at the point where the velocity trace cuts a horizontal hour-line being read for two successive hours, the excess of the latter over the former reading (adding 50 if the trace has passed over from left to right of the form) gives the movement for the interval; and the number of the space in which the direction trace lies during the interval is entered as representing the direction. The estimations of movement are made only to the nearest full mile. Should the direction trace not lie all in one space during the whole interval of an hour, then if the change of direction exceed 90° or eight points, the whole observation for that hourly interval is rejected; but if it lie within that limit, the direction is estimated—by an inspection of the movement and direction traces together—whence the aggregate flow of air was the greatest, and this direction is adopted for the full hour. On the average of the years 1871 to 1883, out of 8,754 hours during which the instrument was in action, 3 only had to be rejected because the direction of the wind varied more than eight points within the hour.

Method of reduction.—Hitherto we have had to speak of phenomena liable only to simple increase and decrease of value, and not subject to any change of quality. Such phenomena being properly and completely evaluated by simple numbers, we may apply to the numbers any arithmetical operations, such as averaging, and infer from the results of those operations corresponding properties of the phenomena. But we have now come to a phenomenon which requires two numbers to express it, one representing its amount and the other a varying quality; the first referring to the velocity, and the last to the direction of the wind. Here we may no longer apply arithmetical processes directly and indiscriminately to the observed numbers: but, the subject being one of motion, we must treat them according to the principles of the science of motion. These principles tell us that the motions may be equally well expressed by means of two varying numbers referring to two invariable qualities, as by a varying number referring to a varying quality; and they show us how to obtain either form of expression from the other. The invariable qualities chosen in the present case are the directions north and east, the actual wind blowing in each hour being resolved into north and east components, which may be regarded separately as the velocity of the wind in the invariable direction north or south, and the velocity of the wind in the invariable direction east or west. The resolutions are effected by means of the formulæ:—

$$\text{North component of velocity of wind} = m \cos (n \times 22\tfrac{1}{2}^\circ),$$
$$\text{East component of velocity of wind} = m \sin (n \times 22\tfrac{1}{2}^\circ),$$

where m is the movement observed, and n the number of the direction space under which the wind of the hourly interval is classed. When the sign of either of these calculated quantities is negative, it implies that the wind blows from the opposite direction, *i. e.* from south or west. The calculations are readily made by means of tables to the nearest tenth of a mile of velocity per hour. Having now substituted the two equivalent winds for the real one, we may with propriety proceed to combine together numbers of observations by algebraical addition and averaging, treating the north and east components of the wind each by themselves. The averages thus found from the observations of any given period will represent the velocity with which the wind must blow from the northward (from the southward if the sign of the average be negative)

* A more detailed account of the Colába anemograph will be found in the "Bombay Magnetical and Meteorological Observations, 1865 to 1870," Appendix I., page 199.

continuously for the whole period, in order that the total movement of the wind from that direction may be the same as the total movement from the same direction produced by the winds which actually blow, and similarly the velocity with which it must blow continuously from the eastward (westward if the sign of the average be negative).

No corrections have been applied to the anemograph tabulations on account of friction.

Rain Gauges.—Newman's rain gauge, which has been in use since 1845, is made of copper and exposes for the collection of rain-drops a circular surface of an average diameter of 12·035 inches, forming the top of a funnel, which opens into a cylindrical vessel below, having a diameter of 5·732 inches: a float of slightly less diameter, so as to rise and fall freely, rests upon the water in this vessel, and having a wholly convex external surface, it allows the rain as it falls to flow off and raise the level of the water and with it the float. To the middle of the float is fixed a wooden rod, graduated with divisions, each of which represents ·05 inch of rain; and the readings of this scale, which are easily estimated to fifths of a division, are made where it is cut by the upper edge of a light brass rod placed horizontally across the mouth of the funnel, but half an inch below the edge of the exposed circular surface; the scale passes through a hole in the middle of the horizontal rod, and is thus kept always in a vertical position. The range of the scale is from 0 to 4·00 inches, and the readings of the scale have been entered in the meteorological register and the differences been taken for every interval between successive observations: the rain has accumulated in the vessel generally till the reading was somewhere above 2·00 inches, when the water was let out, by means of a brass cock at the bottom, till the reading came down to 0·00 inch. This latter reading was also maintained during intervals of dry weather—when, from evaporation, the scale would otherwise have fallen lower—by pouring small quantities of water into the gauge: the reason of this is obvious, as, if some water were not always retained, the float would sometimes rest on the bottom of the vessel and so cease to perform its function of rising equally for equal increments of rain. The scale on the wooden rod was graduated so as to agree approximately with the data—the diameters of the gauge and measuring vessel—given above. The error of the scale according to which the rod was graduated was less than a thousandth of the whole.

Newman's gauge stands on a large rectangular block of stone, in a position intermediate between the Entrance Gate, the Magnetical Observatory, and the Thermograph Shed, where the altitude of the highest neighbouring object, as seen from the gauge, is about 30°. It is supported by three feet, which are embedded with lead in holes cut in the stone block, and its circular mouth is at a height of 4½ feet above the ground and about 35 feet above the mean sea level.

Photographic rain gauge.—A description of this instrument also will be found in the Introduction to the "Bombay Magnetical and Meteorological Observations, 1871 to 1878," page xlvi. In 1896 the syphon discharges were received in glass bottles and measured by means of a graduated glass tube and a marked glass bottle holding exactly half an inch of rain.

It was mentioned in former years that the occurrence of the discharging action of the syphon was occasionally liable to some uncertainty—the water at times trickling over the bend of the tube in considerable quantities before the proper discharge commenced. After trial of many modifications in the form of the syphon one was at last hit upon, which is free from this fault, and by which the tube is, moreover, kept in a satisfactorily clean condition from beginning to end of the monsoon, simply by the washing that takes place in the

ordinary automatic discharges. Since November 1884, when the new syphon was brought into use, the discharges have been regular and unfailing except on two occasions, *viz.*, on the 18th June and 5th November 1890 when trickling again occurred: this was traced, in the last case, to the presence near the bend of the syphon tube of a living cockroach. To prevent this from occurring again, a lid of zinc was fitted to the discharge pipe at its entry into the receiving bottle, so as to cover the mouth of the bottle. To prevent birds alighting upon the funnel, and choking it with their droppings, a conical arrangement of pointed iron spikes surrounding the funnel was attached in 1882, and was found to be effective.

Constants for converting syphon discharges into inches of rainfall.—As the surface exposed by the rain gauge funnel is 50·286 square inches, an inch of rain contains 823·955 cubic centimeters. With the aid of a cubic centimeter measure,* 412 cubic centimeters of water were poured into a narrow-necked glass bottle, and a file mark was made on the bottle neck at the level up to which the water rose. A glass tube was also graduated by means of the same cubic centimeter measure, so as to read off thousandths of an inch of rain with ease. The bottle is filled as often as there have been discharges from the rain gauge syphon, and the final excess or defect is measured with the graduated tube. The use of the bottle began on 31st July 1879 and continued till the 26th July 1884, when it was accidentally broken. An exact copy of it, which had been prepared beforehand, was then substituted for the original bottle, and this copy is still in use.

Measurement and distribution of syphon discharges.—The discharges are measured daily, or oftener during heavy rainfall, and are of course always of an integral number. For each measurement the average value of a discharge is attributed to each of the intervals of time, shown on the rain curve, between pairs of successive discharges; and it remains then only to distribute this quantity, for each filling of the receiving vessel, by means of tabulations of the ordinates of the rain curve. When, as is often the case, the rate of fall of the rain at the time of a discharge exceeds $1\frac{1}{8}$ inch per hour, it is necessary to allow for the rain that enters the receiving vessel during the known time (16 seconds) of discharge, the allowance depending on the rate of rainfall, which is easily estimated for this purpose by noting, with the aid of an appropriate paper scale, the inclination of the rain curve immediately after the time of discharge. The aggregate of such allowances is deducted from a day's (or other) measurement before dividing the quantity equally amongst the several intervals.

Determination of scale of rainfall ordinates.—The factor for converting ordinates of the rainfall curve into inches of rainfall was found by experiments in which a determined weight or volume of distilled water was poured into the receiving vessel, and the change of length of the ordinate produced thereby was carefully measured. In an experiment made on the 25th May, 1896, the quantity of water poured into the vessel was equivalent to ·480 inch of rain, and the change of length of the ordinate ·480 of a true inch; whence the factor is found to be 1·000, which is applicable to all the rainfall registrations of the year 1896.

The tabulations are made with the true-inch scale of the thermograph tabulating instrument, using the white line as datum; and the reading of this datum that shall correspond to the reading ·000 of the rain curve, when the receiving vessel has just been discharged, is re-determined whenever the adjustment of the recording apparatus is disturbed. For this purpose an

* Lent by Mr. F. Chambers, whose verification data show it to be accurate to a thousandth of the 100 cubic centimeters which it is designed to measure.

average is taken of a number of measurements for all of which the rain is falling very slowly at the time of the syphon's coming into action and for a short time longer. It is necessary to select such occasions, because at times of heavy rainfall the curve has risen sensibly before the light has had time to make a distinct impression on the sensitive paper. The mode of tabulating is (1) to set the scale on the constant reading corresponding to the white line, (2) to move the sliding piece until the index is set upon the white line, and (3) to move the sliding bar till the index is set upon the curve, and then read the scale. By setting the paper carefully, so that a considerable length of the white line is practically parallel to the lateral motion of the frame, the repetition of the first two operations of tabulation is avoided until many hourly ordinates have been read; and then a new setting of the paper is made for another stretch of the white line.

(*b*). Magnetical Instruments, 1896.

Kew Unifilar Magnetometer.—A description of this instrument, with which the observations of absolute declination and of horizontal intensity for the year 1896 have been taken, will be found on pages xxxiii to liii of the Introduction to the "Bombay Magnetical and Meteorological Observations, 1865—70"; the description includes also an account of the situation of the instrument, of the nature and routine of the observations taken with it—with examples of observation and computation forms filled up with the figures of actual observations—and of the formulæ of reduction and the constants involved in them.

The entries in columns 1 to 17 and 19 of the Tables of Observations of Absolute Horizontal Force are copied directly from the computation form: column 18 is given to show the degree of accordance existing in the determinations from deflections with the deflecting magnet at the respective distances 0·8 foot and 1·0 foot from the deflected magnet; and the numbers in column 21 are the products of those in column 20 multiplied by the constant number ·46108.

The description, referred to above, of the observation of absolute declination will render clear the meaning of the numbers entered in each column of the Tables of Observations of Absolute Declination: all of these, except the monthly means in columns 12 and 13, are taken directly from the observation form.

Kew Dip Circle.—A description of this instrument, and of the mode of using it, is also given in the Introduction to the "Bombay Magnetical and Meteorological Observations, 1865—70," pages lvi to lix, and the following additional or corrective remarks will make it applicable to the observations of 1896:—

(1) The place of observation has been the top room of the Electrometer Tower, the dip circle having been placed on the same pillar on which the Kew unifilar magnetometer is placed in the regular observations of absolute horizontal force and absolute declination. The reading of the azimuth circle adopted for this place has invariably been 63° 31′. An observation for the verification of this reading was made on the 22nd February 1881.

(2) The dip needles used during the year 1896 have been as follows:—

For the regular observations:—

Dover, Charlton No. 1.
" " No. 2.

And for supplementary observations:—

John Dover No. $\frac{1}{81}$.
" " No. $\frac{2}{81}$.
Adie No. 5.

(3) On 15th December 1896, the axle of needle No. $\frac{1}{61}$ by John Dover broke while cleaning, and during the three observations to complete the yearly set, needle No. 5 by Adie, which had been formerly used and had given satisfactory results, was substituted.

(4) The final cleaning of the axles of the needles has throughout been made with a clean silk cloth.

(8) Processes of Reduction and Description of the Tables of Meteorological Results, 1896.

Pressure of Vapour and additional capacity of the Air.—Having obtained, from the tabulations of the barograms and thermograms, hourly values of barometric pressure, temperature of the air, and temperature of evaporation, the pressure of vapour was calculated for each hour with the aid of a table by the formula

$$f''=f'-\cdot01147\ (t-t')\times\frac{P-f'}{30}$$

in which t and t' denote the temperatures of the air and wet bulb thermometers respectively, f'' and f' the pressure of vapour at the temperature of the dew point and at temperature t', and P the barometric pressure. The values of the pressure of vapour at different temperatures were taken from the following table, the numbers in which have been extracted from Boileau's Collection of Tables:—

Table I.—*Regnault's values of the Pressure of Vapour at different Temperatures.*

Temperature.	Pressure of vapour.	Temperature.	Pressure of vapour.	Temperature.	Pressure of vapour.	Temperature.	Pressure of vapour.	Temperature.	Pressure of vapour.	Temperature.	Pressure of vapour.	Temperature.	Pressure of vapour.	Temperature.	Pressure of vapour.
°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.	°	Inch.
35	·204	43	·278	51	·374	59	·500	67	·662	75	·868	83	1·128	91	1·455
36	·212	44	·288	52	·388	60	·518	68	·685	76	·897	84	1·165	92	1·501
37	·220	45	·299	53	·403	61	·537	69	·709	77	·927	85	1·203	93	1·548
38	·229	46	·311	54	·418	62	·556	70	·733	78	·958	86	1·242	94	1·597
39	·238	47	·323	55	·433	63	·576	71	·758	79	·990	87	1·282	95	1·647
40	·248	48	·335	56	·449	64	·596	72	·784	80	1·023	88	1·324	96	1·698
41	·257	49	·348	57	·466	65	·617	73	·811	81	1·057	89	1·366	97	1·751
42	·267	50	·361	58	·482	66	·639	74	·839	82	1·092	90	1·410	98	1·805

To find the additional capacity of the air the pressure of vapour was deducted from the number in the above table standing opposite to the temperature of the air.

Barometric Pressure.—In Table I is shown, for every day in the year, the mean of 24 hourly tabulations of the barograph, corrected* to agree with Newman's barometer No. 58;—also the mean pressure for each month and each year, and the excess of each monthly mean above the annual mean for the same year; and the principal features of the annual variation are indicated at the foot of the table. The maximum and minimum daily pressures in each month are distinguished by being printed in strong figures.

Temperature of the Air, &c.—The plan of the following tables is the same as that of Table I, but the subjects of them and the sources from which the numbers are obtained and the mode of obtaining them are as stated below:—

Table II.—Temperature of the air: derived from hourly tabulations of the thermograph dry-bulb.

Table III.—Pressure of vapour: derived from hourly tabulations of the thermograph dry-bulb and wet-bulb, and of the barograph; and calculated in the manner described above.

* In the manner described in paragraph 54 of the Introduction of the "Bombay Magnetical and Meteorological Observations for 1871 to 1878."

Table IV.—Additional capacity of the air: derived from hourly differences between the pressure of vapour corresponding to the temperature of the air and the calculated actual pressure of vapour.

Table VII.—Velocities of the north and east components of the wind: derived from hourly tabulations from the register of the Robinson-Beckley anemograph.

Table VIII.—Velocity of the wind regardless of direction: derived from hourly tabulations from the register of the Robinson-Beckley anemograph.

Table XI.—Extent of cloudy sky: derived from estimations made at the hours 6, 10, 14, 16 and 22 daily.

Tables VI and XII are on the same plan as Table I, except that the entries made in them are aggregates—daily, monthly and yearly—instead of mean values; and they are sufficiently explained by their several headings.

Monthly and annual range of variation of Meteorological Elements.—Table V shows the extreme limits between which the oscillations of barometric pressure, temperature of the air, pressure of vapour, and additional capacity of the air were confined in each month and in the whole year, and also the ranges of the respective oscillations.

The numbers in Table IX are derived from hourly tabulations from the register of the Robinson-Beckley anemograph. The temperatures of the ground given in Table X are derived from the readings of the several thermometers, made five times a day as regards the 1 inch and 9 inches deep thermometers, and once a day as regards the 20 inches, 60 inches and 132 inches deep thermometers. The five-day means of Table XIII are derived from hourly tabulations of the barograph (combined with readings of Newman's barometer No. 58) and thermograph, from the measurements in Newman's rain-gauge, and from hourly tabulations from the register of the Robinson-Beckley anemograph. In other respects these tables require no explanation beyond their titles, the headings of the several columns, and the foot notes.

(9) NOTES ON INSTRUMENTAL CHANGES AND ON ALL IRREGULARITIES OR DEPARTURES FROM THE ROUTINE OF OBSERVATION OR REDUCTION IN 1896.

Robinson-Beckley Anemograph.—Instrument dismounted, cleaned and adjusted on May 7, 9 and 11, and on December 12. External parts painted on July 10. The aggregate of all the interruptions of the instrument in the year 1896 was $15^h\ 24^m$: the loss of record was, however, rarely complete, and values partly or entirely interpolated have been inserted whenever the interruption was not somewhat prolonged. To aid in the making of interpolations, it has been customary, whenever the action of the instrument was voluntarily interrupted for more than one hour, to observe the direction of the wind by estimation, and to record the readings of a small auxiliary velocity measurer put up for the occasion. No complete day's records have been omitted in the formation of monthly abstracts.

When for any reason the traces furnished by the photographic self-registering instruments are interrupted, and the interruption includes the moments when one or more hourly tabulations should be made, these last are either substituted by the corresponding eye-observations, if the hours should happen to be any of the five regular observation hours, or if special eye-observations were taken for the purpose, or else, if no eye-observations are available, they are interpolated. Interpolation is resorted to rarely and only in case of accidents, otherwise eye-observations are always made so as to keep the record unbroken. If the interruption lasts for less time than one hour, the interpolation is made on the assumption that the rate of change of the phenomenon from its value at the beginning to its value at the end of the interruption was uniform,

providing that the parts of the curve immediately preceding and immediately following the gap were, in appearance, continuations of the straight line connecting the extremities of the gap. If the last condition is not satisfied, or if the gap, taking account of points inserted by means of eye-observations, is of greater length than one hour, the interpolation is made between the next preceding and the next following hourly entries, first, by allowing for the known *normal* rate of change of the phenomenon between those hours in the same month, and then by assuming that any additional change, shown by the difference between the values of the phenomenon at the two extreme hours, has grown at a uniform rate. Interpolated values are entered in the abstract sheets with enclosing square brackets—inserted eye-observations between parentheses.

Barograph.—No tabulation was obtained for (11) to (14) hours of 13th March 1896 on account of the clock being taken to pieces for cleaning, but eye-observations were available and were adopted.

Occasional, though rare, failure of the bi-hourly stops to act, has caused no loss of record.

The aggregate of all the interruptions of the barograph in the year 1896 was $5^h\ 2^m$, and the number of hourly tabulations lost was 4, which were substituted by eye-observations. Short interruptions caused by the regular change of photographic papers and by change of lamps, if not unusually prolonged, are not included in the above aggregate, nor in the aggregates of interruptions of the thermograph that follow further on.

Thermograph dry-bulb.—No tabulations were obtained for the following hours for the several reasons stated, but eye-observations were available in all cases and were adopted for the hours marked within parentheses.

(1) Clock being taken to pieces for cleaning: for 1896 May 5^d (11^h) to (15^h).

(2) Photographs taken of the apparatus: for 1896 August 31^d (10^h).

Occasional, though rare, failure of the bi-hourly stops to act, has caused no loss of record.

The aggregate of all the interruptions of the thermograph dry-bulb in the year 1896 was $5^h\ 52^m$ and the number of hourly tabulations lost was 6, which were substituted by eye-observations.

Thermograph wet-bulb.—No tabulations were obtained for the following hours for the several reasons stated, but eye-observations were available in all cases and were adopted for the hours marked within parentheses.

(1) Clock being taken to pieces for cleaning: for 1896 May 5^d (11^h) to (15^h).

(2) Photographs taken of the apparatus: for 1896 August 31^d (10^h).

Occasional, though rare, failure of the bi-hourly stops to act, has caused no loss of record.

The aggregate of all the interruptions of the thermograph wet-bulb in the year 1896 was $14^h\ 44^m$, made up chiefly of short intervals of time occupied in cleaning and renewing the muslin coverings of the bulbs and the bundles of threads connecting them with the supply of water. The number of hourly tabulations lost was 6, which were substituted by eye-observations.

Self-registering Rain-gauge.—No hourly tabulations were lost in the year 1896 except on one occasion—on August 14 between 10 and 14 hours. This was due to heavy fall of rain in a short period resulting in overflow of the receiving vessel before it could discharge. The loss was estimated to be 0·17 inch by comparison of the registered fall with that of Newman's gauge. Precautions have been adopted by modifying the apparatus to prevent such loss in future.

N. A. F. MOOS,
Director.

Colába Observatory, August 1897.

TABLES OF RESULTS

DERIVED

FROM THE CONTINUOUS REGISTRATIONS OF AUTOMATIC METEOROLOGICAL INSTRUMENTS

AND FROM

METEOROLOGICAL OBSERVATIONS,

1896.

TABLES OF RESULTS

DERIVED FROM THE

METEOROLOGICAL OBSERVATIONS MADE DAILY AT 6, 10, 14, 16 AND 22 HOURS,

1896.

FIVE-DAY MEANS,

1896.

B 521—1 B

TABLE I.—Barometric Pressure, 1896.

Height of Barometer above mean Sea-level = 37 feet.

1896. Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
1	29·922	29·977	29·896	29·769	29·804	**29·784**	29·635	29·639	29·771	29·859	29·909	29·923
2	·918	·957	·860	·802	·778	·755	·667	·637	**·766**	·829	·902	·932
3	·923	·950	·835	**·849**	**·766**	·761	·673	**·613**	·795	·826	·871	·929
4	·932	·949	·841	·796	·770	·737	·634	·633	·829	·813	·873	·910
5	·957	·983	·846	·751	·780	·720	·676	·704	·842	·787	·858	·937
6	·961	·980	·892	·770	·769	·678	·706	·761	·833	**·775**	·860	·975
7	·962	·924	·894	·762	·796	·664	·726	·761	·806	·805	·891	·998
8	·982	·909	·895	·780	·814	·675	·772	·750	·829	·838	·892	**30·005**
9	**·999**	**·894**	·897	·812	·818	·650	·769	·739	·858	·865	·878	29·989
10	·963	·897	·884	·788	·863	·599	·717	·745	·852	·840	·864	·966
11	·955	·918	·876	·757	**·868**	·655	·679	·719	·814	·847	·845	·936
12	·936	·911	·851	·757	·813	·723	·661	·690	·808	·881	·820	·949
13	·941	·901	·831	·776	·769	·694	·632	·688	·810	·905	·837	·967
14	·947	·899	·841	·735	·785	·617	·580	·682	·790	·911	·853	·969
15	·977	·919	·844	**·706**	·790	·525	·629	·644	·798	·890	·828	·966
16	·985	·914	·825	·718	·805	·436	·740	·662	·805	·871	·815	·946
17	·966	·918	·825	·759	·795	**·407**	·792	·756	·810	·878	·824	·883
18	·941	·912	·859	·762	·776	·426	·790	·786	·823	·877	·817	**·859**
19	·925	·945	·833	·789	·782	·417	·790	·761	·850	·915	·836	·876
20	·927	·946	**·772**	·801	·793	·425	**·834**	·749	**·860**	·911	**·787**	·916
21	·935	·963	·776	·760	·818	·464	·779	·767	·858	·912	·796	·957
22	·909	·968	·854	·762	·806	·520	·688	·775	·859	·921	·815	·967
23	·936	·952	·891	·802	·793	·641	·610	·788	·839	·917	·841	·961
24	·962	·997	·879	·832	·781	·707	·552	·794	·823	·904	·884	·956
25	·939	**30·019**	·839	·796	·787	·706	·506	·783	·818	·915	·917	·982
26	**·899**	·009	**·920**	·788	·782	·620	·585	·790	·812	·935	·918	·992
27	·907	29·996	·865	·793	·775	·583	·625	·825	·807	**·942**	·897	·991
28	·941	·954	·814	·767	·776	·644	·571	·780	·798	·928	·918	·993
29	·961	·923	·785	·749	·783	·667	**·501**	·748	·818	·908	**·962**	·957
30	·946		·778	·780	·824	·652	·516	·817	·859	·903	·958	·979
31	·956		·782		·823		·586	**·832**		·899		·988
Monthly Mean.	29·945	29·944	29·848	29·776	29·796	**29·618**	29·665	29·736	29·821	29·878	29·865	**29·953**
Annual Variation ...	+·125	+·124	+·028	—·044	—·024	—·202	—·155	—·084	+·001	+·058	+·045	+·133

	in.
Annual mean	29·820
The greatest mean daily barometric pressure in the year (that of 25th February) was	30·019
The least do. do. do. (that of 17th June) was	29·407
Difference =	0·612

TABLE II.—Temperature of the Air, 1896.

1896. Date.	MONTH. January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	°	°	°	°	°	°	°	°	°	°	°	°
1	78·1	73·7	78·1	82·6	84·5	**86·8**	82·9	79·5	81·0	84·2	82·3	**80·9**
2	**78·4**	75·2	78·7	83·6	**84·1**	85·2	82·2	79·7	81·0	83·6	82·1	80·9
3	77·8	76·2	78·2	83·7	84·1	82·1	82·9	79·0	81·3	83·8	81·6	80·1
4	75·9	75·9	77·2	82·7	84·5	83·9	81·1	77·8	81·5	85·2	81·6	78·4
5	75·0	75·3	76·1	82·5	85·2	84·1	82·9	80·7	81·5	**85·5**	82·2	78·3
6	75·9	74·8	**76·0**	82·9	84·8	85·7	**83·3**	**81·4**	80·7	84·4	82·2	79·9
7	76·1	73·2	76·6	84·4	85·5	84·8	82·7	81·2	80·2	84·1	82·3	79·7
8	75·4	**72·8**	76·9	85·4	85·9	85·3	82·1	79·0	81·5	83·5	82·4	78·8
9	76·0	74·4	76·5	85·9	85·8	85·1	83·3	77·9	81·7	82·9	83·1	78·8
10	76·3	75·6	76·1	**87·4**	85·3	85·8	81·6	77·7	81·4	82·5	83·2	77·6
11	76·6	75·7	78·0	86·0	85·2	85·8	81·7	79·5	81·2	82·4	83·3	78·3
12	76·3	75·8	78·0	83·8	84·8	84·5	79·1	77·9	82·0	82·3	83·6	78·8
13	76·0	74·8	78·3	82·6	85·5	85·6	78·5	79·2	81·2	82·5	82·6	78·5
14	76·0	75·7	78·2	83·1	85·3	84·4	80·1	**77·3**	**79·3**	82·3	81·9	78·8
15	75·4	75·8	78·0	83·3	84·9	83·0	81·0	77·3	81·5	**82·1**	81·4	78·2
16	75·7	75·1	77·8	83·5	85·2	82·5	82·2	77·8	81·4	82·6	82·4	76·6
17	75·2	74·9	77·0	84·5	86·1	80·0	82·0	80·2	81·0	82·9	82·6	76·9
18	74·1	73·7	77·5	84·0	87·0	81·6	80·7	79·9	80·9	83·5	**83·9**	76·3
19	**73·5**	75·1	78·9	83·1	86·8	80·9	80·9	80·0	81·8	83·4	83·3	78·1
20	74·4	74·1	80·0	**82·3**	86·9	80·5	79·3	79·4	82·0	83·1	82·2	80·1
21	75·2	73·5	81·1	84·7	86·4	81·0	80·3	80·6	81·9	82·9	81·0	78·6
22	75·2	73·8	80·7	84·8	86·5	**79·9**	80·1	79·7	81·6	82·8	77·0	78·7
23	75·8	74·9	83·3	84·7	86·3	81·9	80·6	80·2	81·5	82·8	**72·6**	78·8
24	76·4	76·2	**84·1**	84·3	86·4	83·2	79·6	80·3	81·6	83·1	73·7	77·8
25	77·7	76·5	83·2	84·1	86·4	83·2	79·0	80·5	81·1	84·1	76·1	76·0
26	76·8	76·4	81·5	84·7	87·1	82·4	80·5	80·2	80·5	83·9	77·9	75·2
27	76·9	77·0	82·9	85·6	87·0	83·2	80·0	79·4	81·8	83·1	78·6	77·0
28	76·7	**75·2**	83·6	85·3	86·8	83·7	79·9	80·4	83·3	83·5	79·1	75·7
29	75·3	78·1	82·9	85·1	86·0	83·5	**78·2**	80·2	**84·8**	83·9	80·4	74·0
30	73·8		83·6	84·5	**87·2**	82·0	78·5	80·2	84·3	84·5	81·7	72·7
31	73·7		82·5		87·2		79·2	80·2		82·9		**72·2**
Monthly Mean.	75·9	**75·3**	79·4	84·2	**85·8**	83·4	80·9	79·5	81·6	83·4	81·0	77·8
Annual Variation ...	—4·8	—5·4	—1·3	+3·5	+5·1	+2·7	+0·2	—1·2	+0·9	+2·7	+0·3	—2·9

	°
Annual mean	80·7
The greatest mean daily temperature of the air in the year (that of 10th April) was	87·4
The least do. do. do. (that of 31st December) was	72·2
Difference =	15·2

TABLE III.—Pressure of Vapour, 1896.

1896. Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
1	0·735	0·667	0·666	0·924	0·874	0·966	0·916	0·887	0·852	0·964	0·707	0·801
2	·728	·646	·687	·929	·884	·958	·924	·893	·820	·881	·733	·803
3	·666	·687	·728	·937	873	·927	·943	·879	·825	·920	·751	·718
4	·637	·688	·653	·903	·906	·978	·929	·871	·825	·927	·780	·638
5	·607	·648	·657	·837	·939	·974	·941	·895	·813	·930	·849	·738
6	·580	·562	·654	·764	·951	·985	·934	·913	·816	1·003	·842	·723
7	·608	·566	·667	·775	·942	·979	·937	·907	·845	·964	·826	·718
8	·611	·572	·677	·819	·924	·950	·938	·876	·840	·939	·831	·657
9	·591	·587	·680	·873	·935	·950	·920	·881	·820	·900	·749	·644
10	·558	·602	695	·816	·873	·954	·894	·871	·813	·878	·793	·554
11	·555	·613	·727	·749	·840	·943	·909	·893	·814	·875	·789	·608
12	·630	·578	·772	·847	·879	·965	·892	·863	·818	·897	·776	·635
13	·665	·521	·757	·873	·882	·967	·909	·876	·836	·940	·797	·586
14	·621	·528	·749	·907	·878	·984	·923	·864	·828	·915	·746	·521
15	·606	·620	·745	·932	·864	·957	·925	·859	·822	·902	·731	·544
16	·589	·642	·738	·927	·847	·954	·929	·849	·785	·939	·723	·552
17	·542	·652	·717	·930	·913	·943	·914	·885	·788	·951	·674	·557
18	·549	·628	·724	·792	·955	·948	·902	·873	·792	·834	·607	·573
19	·568	·620	·786	·751	·979	·945	·904	·870	·830	·841	·742	·579
20	·620	·569	·815	·779	·945	·911	·877	·870	·840	·862	·850	·693
21	·644	·557	·805	·815	·902	·925	·893	·876	·851	·877	·810	·699
22	·665	·630	·800	·842	·908	·909	·897	·872	·834	·921	·688	·668
23	·666	·659	·713	·884	·910	·927	·913	·869	·849	·918	·593	·727
24	·637	·666	·705	·939	·914	·946	·904	·877	·896	·923	·608	·719
25	·680	·678	·755	·953	·925	·933	·869	·865	·920	·871	·681	·483
26	·703	·694	·804	·963	·980	·923	·889	·818	·878	·789	·751	·582
27	·715	·752	·742	·925	·958	·934	·889	·808	·927	·786	·762	·721
28	·649	·682	·812	·900	·955	·941	·894	·819	·902	·792	·812	·716
29	·619	·638	·850	·882	·944	·943	·890	·842	·952	·791	·824	·590
30	·595		·840	·892	·951	·920	·877	·847	·968	·717	·835	·465
31	·639		·920		·944		·876	·862		·714		·489
Monthly Mean...	0·628	0·629	0·743	0·869	0·915	0·943	0·908	0·868	0·847	0·883	0·755	0·636
Annual Variation ...	—·174	—·173	—·059	+·067	+·113	+·146	+·106	+·066	+·045	+·081	—·047	—·166

	in.
Annual mean	0·802
The greatest mean daily pressure of vapour in the year (that of 6th October) was	1·003
The least do. do. do. (that of 30th December) was ...	0·465
Difference =	0·538

TABLE IV.—Additional Capacity of the Air, 1896.

1896. Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
1	0·232	0·170	0·300	0·193	0·315	0·314	0·210	0·120	0·207	0·212	0·403	0·255
2	·249	·233	·300	·224	·287	·254	·175	·122	·240	·270	·371	·253
3	·292	·222	·242	·221	·298	·173	·184	·117	·245	·243	·332	·313
4	·261	·212	·286	·218	·282	·189	·133	·083	·250	·287	·306	·339
5	·267	·238	·246	·278	·277	·198	·185	·154	·264	·295	·256	·234
6	·320	·301	·247	·368	·247	·249	·207	·160	·233	·179	·264	·305
7	·303	·252	·250	·413	·285	·220	·183	·161	·187	·206	·280	·301
8	·276	·241	·252	·401	·320	·269	·160	·114	·236	·210	·284	·333
9	·315	·272	·235	·372	·301	·259	·222	·076	·262	·229	·389	·346
10	·355	·292	·211	·492	·344	·281	·189	·078	·259	·238	·350	·399
11	·371	·280	·234	·498	·373	·294	·175	·115	·250	·233	·361	·372
12	·284	·317	·190	·315	·321	·221	·102	·094	·278	·211	·385	·355
13	·236	·350	·214	·243	·341	·261	·067	·120	·233	·172	·323	·397
14	·285	·268	·220	·228	·339	·196	·104	·071	·172	·190	·350	·472
15	·282	·275	·219	·212	·340	·175	·133	·079	·253	·197	·345	·428
16	·305	·234	·218	·226	·365	·159	·173	·102	·287	·179	·391	·371
17	·337	·217	·215	·261	·337	·082	·177	·148	·272	·176	·446	·377
18	·300	·207	·221	·381	·332	·130	·147	·149	·265	·321	·568	·342
19	·264	·254	·206	·387	·299	·111	·149	·154	·257	·308	·401	·392
20	·238	·280	·211	·330	·337	·133	·126	·133	·252	·278	·256	·341
21	·233	·274	·262	·384	·360	·135	·142	·169	·239	·252	·248	·281
22	·214	·209	·250	·359	·355	·112	·131	·143	·248	·205	·240	·319
23	·232	·210	·434	·314	·347	·166	·132	·162	·227	·205	·204	·260
24	·281	·239	·470	·239	·349	·192	·107	·158	·184	·211	·230	·237
25	·276	·237	·386	·221	·336	·204	·121	·178	·145	·304	·225	·419
26	·222	·217	·272	·232	·311	·184	·152	·213	·166	·378	·207	·297
27	·214	·177	·390	·304	·327	·201	·136	·197	·165	·355	·220	·209
28	·272	·287	·343	·319	·327	·214	·127	·219	·244	·359	·184	·175
29	·261	·328	·279	·331	·302	·204	·076	·188	·247	·382	·218	·250
30	·244		·313	·297	·344	·174	·097	·186	·211	·474	·254	·342
31	·199		·191		·349		·121	·171		·417		·309
Monthly Mean.	0·272	0·252	0·268	0·309	0·324	0·198	0·147	0·140	0·233	0·264	0·310	0·323
Annual Variation	+·019	—·001	+·015	+·056	+·071	—·055	—·106	—·113	—·020	+·011	+·057	+·070

	in.
Annual mean	0·253
The greatest mean daily additional capacity of the air in the year (that of 18th November) was.	0·568
The least do. do. do. (that of 13th July) was.	0·067
Difference =	0·501

Maxima and Minima of different Meteorological Elements, 1896.

TABLE V.—*In which are collected the individual observations in each month of the year, which showed the greatest and the least values of the following elements, viz., Height of Barometer, corrected for Temperature; Temperature of Air; Pressure of Vapour; and Additional Capacity of Air.*

1896.	HEIGHT OF BAROMETER.			TEMPERATURE OF AIR.			PRESSURE OF VAPOUR.			ADDITIONAL CAPACITY.		
Month.	Greatest.	Least.	Range.	Greatest.	Least.	Range.	Greatest.	Least.	Range.	Greatest.	Least.	Range.
	in.	in.	in.	°	°	°	in.	in.	in.	in.	in.	in.
January ...	30·078	29·833	0·245	87·2	66·7	20·5	0·877	0·387	0·490	0·752	0·083	0·669
February .	·094	·829	·265	83·6	67·2	16·4	·806	·347	·459	·571	·073	·498
March ...	·003	·697	·306	89·7	70·3	19·4	·960	·477	·483	·720	·075	·645
April ...	29·920	·657	·263	92·6	76·8	15·8	1·007	·617	·390	·863	·090	·773
May ...	·932	·703	·229	91·7	80·5	11·2	·035	·816	·219	·531	·137	·394
June ...	·835	·356	·479	91·1	75·7	15·4	·051	·790	·261	·476	·041	·435
July ...	·870	·452	·418	86·5	76·0	10·5	0·996	·774	·222	·318	·034	·284
August ...	·877	·568	·309	84·5	75·7	8·8	·963	·763	·200	·330	·040	·290
September.	·924	·716	·208	89·5	75·6	13·9	1·022	·681	·341	·484	·066	·418
October ...	30·019	·719	·300	93·7	77·6	16·1	·071	·537	·534	1·016	·061	·955
November.	·039	·718	·321	91·9	67·9	24·0	0·944	·462	·482	·020	·087	·933
December .	·090	·810	·280	87·4	64·8	22·6	·890	·359	·531	0·879	·098	·781
Year ...	30·094	29·356	0·738	93·7	64·8	28·9	1·071	0·347	0·724	1·020	0·034	0·986

Rainfall, 1896.

TABLE VI.—*Total fall of rain (in inches) as measured by F. Chambers's Self-registering Gauge, the funnel of which is 28 feet above the ground.*

1896. Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
					in.	in.	in.	in.	in.	in.	in.	
1	...	...	...	...	...	0·06	0·05	0·50	...	...	...	...
2	...	...	...	...	...	0·30	1·08	0·62	...	...	...	...
3	...	...	...	...	...	1·53	0·06	0·50	...	...	...	...
4	...	...	...	...	...	2·16	3·53	2·29	...	...	...	...
5	...	...	...	...	...	0·78	0·05	0·07	...	...	...	...
6	...	...	...	...	...	0·20	0·04	0·01	...	...	...	...
7	...	...	...	...	...	...	0·07	0·06	**0·53**	...	...	...
8	...	...	...	...	...	0·04	0·20	1·07	...	...	...	...
9	...	...	...	...	...	0·01	**0·02**	1·87	...	...	...	...
10	...	...	...	...	...	...	1·74	2·54	0·01	...	...	...
11	...	...	...	...	...	...	0·28	0·71	0·08	...	...	...
12	...	...	...	...	...	0·74	2·77	1·38	...	...	...	...
13	...	...	...	...	...	0·01	1·95	0·56	0·06	...	...	...
14	...	...	...	...	...	0·81	1·50	[2·71]	0·29	...	...	...
15	...	...	...	...	...	0·08	1·94	**2·87**	0·02	...	...	...
16	...	...	...	...	...	1·41	0·33	0·68	...	...	...	...
17	...	...	...	...	...	2·42	0·08	0·17	...	...	...	...
18	...	...	...	...	0·05	1·39	0·55	0·15	0·18	...	...	...
19	...	...	...	...	...	1·53	1·07	0·05	...	...	0·08	...
20	...	...	...	...	...	2·36	2·40	0·31	...	...	...	...
21	...	...	...	...	...	2·66	0·79	...	...	...	**0·23**	...
22	...	...	...	...	...	**6·02**	1·25	0·23	...	...	...	...
23	...	...	...	...	...	0·75	0·50	0·01	...	...	...	...
24	...	...	...	...	...	0·05	1·77	0·07	...	...	...	...
25	...	...	...	...	...	0·09	2·41	0·12	0·31	...	...	...
26	...	...	...	...	...	0·58	0·47	...	...	...	...	...
27	...	...	...	...	...	0·04	0·40	0·13	...	...	...	...
28	...	...	...	...	**0·20**	0·02	1·99	...	...	...	0·14	...
29	...	...	...	...	...	0·07	**3·91**	0·16	...	...	...	...
30	...	...	...	...	...	0·27	1·77	0·51	...	...	...	...
31	...	...	...	...	...	...	0·39	0·05	...	...	...	...
Monthly Total.	...	...	...	...	0·25	26·38	**35·36**	20·40	1·48	...	0·45	...
Number of rainy days.	...	...	...	...	2	27	**31**	28	8	...	3	...

Total fall of rain in the year ... ... 84·32 inches.
Total number of rainy days in the year 99
The greatest daily fall of rain in the year (that of 22nd June) was ... ... 6·02 inches.

No rain fell in the months of January, February, March, April, October, and December, nor on any of the days left blank in the above table.

The entry in square brackets—August 14—is inferred from the simultaneous fall in Newman's gauge.

Mean Daily Velocities of the North and East Components of the Wind, 1896.

TABLE VII.—*Showing the Mean Velocities of the North or South and East or West Components of the Winds which blew on each day of the year 1896.*

In Miles per Hour.

1896.	MONTH.																							
Date.	January.		February.		March.		April.		May.		June.		July.		August.		September.		October.		November.		December.	
	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S	E. or W.	N. or S.	E. or W.	N. or S.	E.or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W	N. or S.	E. or W.	N. or S.	E. or W.
1 ...	5·5 N	1·1 W	9·6 N	2·7 W	13·1 N	4·6 W	7·5 S	4·0 W	5·3 N	7·3 W	3·1 N	10·2 W	7·6 S	13·4 W	4·5 S	18·0 W	5·7 S	4·7 W	1·1 N	3·1 W	6·8 N	3·0 W	3·8 N	2·0 W
2 ...	5·0 N	1·3 E	9·6 N	3·6 W	9·5 N	4·8 W	6·1 S	4·4 W	7·0 N	6·7 W	1·3 N	5·4 W	6·8 S	13·4 W	6·0 S	16·4 W	4·6 S	6·9 W	6·3 N	2·1 W	7·3 N	0·7 E	6·0 N	0·8 W
3 ...	4·0 N	0·6 E	10·6 N	3·3 W	7·9 N	6·5 W	2·9 S	4·4 W	3·0 N	5·8 W	2·0 N	6·7 W	5·3 S	18·3 W	4·4 S	21·1 W	1·4 S	5·8 W	6·2 N	1·9 W	7·5 N	3·2 W	9·3 N	4·6 W
4 ...	6·3 N	0·5 W	9·7 N	2·1 W	5·9 N	5·4 W	1·2 S	4·3 W	3·2 N	5·6 W	0·2 S	3·2 W	6·0 S	17·5 W	2·2 S	17·1 W	2·0 N	7·1 W	6·6 N	0·6 W	5·6 N	2·2 W	7·0 N	3·4 W
5 ...	1·8 N	0·2 E	11·4 N	4·3 W	4·6 N	6·1 W	2·9 N	5·4 W	3·6 N	8·5 W	1·5 N	2·6 W	3·3 S	19·6 W	6·9 S	16·7 W	3·1 N	6·3 W	3·6 N	1·3 W	2·6 N	2·5 W	3·2 N	0·6 W
6 ...	2·9 N	2·8 E	15·9 N	7·6 W	2·0 N	3·3 W	9·5 N	5·4 W	3·9 N	7·5 W	3·8 N	2·6 W	1·7 S	19·8 W	3·6 S	13·8 W	0·5 N	4·7 W	5·0 S	1·7 W	1·9 N	0·2 E	4·0 N	2·3 E
7 ...	4·2 N	2·3 E	12·3 N	5·2 W	4·6 N	4·9 W	13·2 N	6·8 W	2·8 S	7·0 W	5·0 S	0·9 E	2·4 S	14·8 W	1·6 S	15·8 W	0·5 S	3·7 W	0·4 S	2·0 W	2·4 N	3·4 W	2·9 N	0·3 E
8 ...	3·4 N	0·4 E	8·3 N	2·5 W	6·2 N	3·9 W	3·1 N	4·2 W	3·0 S	6·6 W	12·2 S	0·1 W	2·2 S	14·3 W	0·3 N	16·3 W	0·8 N	7·4 W	5·0 N	3·6 W	5·8 N	2·3 W	4·8 N	1·9 W
9 ...	6·7 N	0·3 W	8·5 N	2·9 W	7·9 N	5·9 W	7·6 N	4·0 W	1·6 S	7·2 W	12·1 S	0·9 W	4·3 S	14·4 W	1·5 S	12·2 W	0·8 N	7·4 W	4·9 N	2·2 W	4·3 N	0·6 W	6·1 N	1·3 E
10 ...	7·8 N	1·4 E	4·8 N	2·4 W	9·8 N	5·8 W	11·3 N	6·5 W	0·0	6·6 W	11·2 S	0·6 E	5·2 S	12·8 W	3·0 S	15·5 W	0·1 S	8·2 W	5·2 N	1·2 W	0·3 N	0·1 E	9·5 N	1·4 W
11 ...	5·3 N	2·0 E	9·7 N	4·3 W	11·5 N	8·3 W	11·7 N	7·9 W	1·5 N	8·7 W	24·1 S	2·1 E	3·4 S	20·9 W	2·8 S	14·2 W	0·2 N	11·7 W	9·2 N	5·1 W	1·3 N	5·2 W	5·8 N	0·3 E
12 ...	1·1 N	3·2 E	14·4 N	4·8 W	6·8 N	6·3 W	4·3 N	6·7 W	0·6 N	7·5 W	9·3 S	4·0 W	3·4 S	4·0 W	1·5 S	15·9 W	0·2 S	13·4 W	7·3 N	4·2 W	4·0 N	0·2 E	5·6 N	1·1 E
13 ...	0·2 N	0·1 E	8·7 N	3·3 W	0·9 N	5·8 W	0·5 N	6·8 W	0·5 N	7·4 W	1·8 S	5·0 W	0·5 S	5·0 W	1·3 S	15·8 W	2·4 S	9·2 W	5·1 N	5·6 W	5·4 N	3·2 W	5·8 N	2·3 E
14 ...	4·5 N	0·8 E	5·4 N	0·9 W	2·3 N	3·5 W	1·3 S	4·6 W	0·7 N	8·1 W	0·7 N	3·1 W	1·6 N	18·3 W	0·9 N	16·9 W	0·5 N	6·8 W	3·6 N	5·0 W	5·2 N	1·0 E	5·9 N	9·7 E
15 ...	4·0 N	1·0 E	7·1 N	4·1 W	1·1 N	3·7 W	1·4 N	5·4 W	0·5 N	7·4 W	2·9 S	0·6 W	3·9 S	20·2 W	0·3 N	24·8 W	0·9 N	11·1 W	4·4 N	5·0 W	4·7 N	1·4 W	7·5 N	6·7 E
16 ...	9·1 N	0·6 W	7·4 N	4·1 W	3·1 N	5·6 W	4·3 N	7·3 W	0·1 N	7·4 W	15·7 S	1·2 E	7·5 S	19·1 W	4·5 S	22·3 W	0·0	8·9 W	5·6 N	2·7 W	3·5 N	0·7 E	8·7 N	3·7 E
17 ...	9·6 N	0·9 W	8·9 N	5·8 W	3·0 N	5·5 W	2·0 S	5·3 W	1·1 S	5·3 W	15·5 S	1·5 E	5·7 S	17·1 W	6·9 S	18·1 W	0·5 N	4·0 W	2·4 N	2·2 W	6·8 N	0·2 E	7·3 N	4·9 E
18 ...	7·8 N	0·4 W	4·9 N	2·3 W	6·6 N	7·1 W	6·1 N	4·3 W	1·8 S	7·6 W	17·1 S	9·3 W	4·3 S	13·8 W	2·2 S	18·3 W	1·1 N	5·5 W	4·2 N	2·1 W	4·3 N	10·9 E	7·4 N	0·2 E
19 ...	6·7 N	2·7 W	6·7 N	2·3 W	9·0 N	6·5 W	4·8 N	7·6 W	2·0 S	6·6 W	13·6 S	13·8 W	6·8 S	17·3 W	7·0 S	13·2 W	2·1 N	4·7 W	1·1 N	0·8 E	2·0 S	13·3 E	7·8 N	1·5 W
20 ...	4·4 N	0·7 W	6·4 N	4·1 W	9·4 N	5·6 W	4·9 N	6·0 W	2·3 N	8·0 W	7·9 S	18·6 W	6·1 S	15·2 W	7·7 S	11·7 W	2·7 N	5·4 W	2·0 N	0·8 E	21·2 S	8·2 E	4·5 N	2·2 E
21 ...	2·2 N	1·0 E	6·1 N	3·4 W	9·2 N	6·9 W	9·4 N	6·6 W	3·6 N	8·3 W	12·6 S	20·0 W	7·7 S	21·0 W	5·5 S	11·9 W	3·8 N	3·8 W	0·6 N	0·6 W	5·7 S	10·9 W	8·5 N	2·0 W
22 ...	2·5 N	0·6 E	5·8 N	3·8 W	7·0 N	6·4 W	5·4 N	5·0 W	2·4 N	7·6 W	7·3 S	23·3 W	7·7 S	21·7 W	4·1 S	12·8 W	5·8 N	4·2 W	1·5 N	4·5 W	8·3 N	3·0 W	4·9 N	0·1 W
23 ...	3·9 N	1·0 W	2·7 N	2·9 W	13·7 N	5·4 W	1·8 S	4·8 W	1·3 N	7·4 W	6·4 S	17·5 W	4·1 S	20·4 W	1·2 S	10·9 W	6·7 N	3·4 W	5·6 N	6·2 W	10·6 N	0·7 W	6·0 N	0·6 W
24 ...	4·9 N	1·0 E	0·5 S	2·7 W	13·6 N	3·7 W	0·9 S	4·8 W	3·5 N	7·5 W	6·0 S	13·2 W	1·5 N	23·9 W	0·5 S	9·4 W	6·6 N	5·6 W	8·1 N	4·4 W	9·8 N	3·3 W	8·9 N	2·3 W
25 ...	1·2 N	1·7 E	4·9 N	2·2 W	9·5 N	6·1 W	1·5 N	6·0 W	0·3 N	5·1 W	5·7 S	13·8 W	1·7 N	36·1 W	0·1 S	10·4 W	4·8 N	1·4 W	3·2 N	0·6 W	4·8 N	4·1 W	13·1 N	2·8 W
26 ...	0·5 N	0·0	11·9 N	5·9 W	1·6 N	5·9 W	4·5 S	5·2 W	7·8 S	3·6 W	7·3 S	18·6 W	2·2 S	28·8 W	0·2 S	9·0 W	0·7 N	0·0	1·9 N	0·3 E	5·6 N	3·0 W	4·6 N	1·7 W
27 ...	1·9 S	0·8 W	8·5 N	3·1 W	11·1 N	5·3 W	6·0 S	5·4 W	11·8 S	2·8 W	7·4 S	13·0 W	8·7 S	24·2 W	2·6 S	8·3 W	3·8 N	0·0	2·5 N	0·6 W	5·4 N	3·3 W	2·0 N	3·9 W
28 ...	2·1 N	3·3 W	7·3 N	2·4 W	9·8 N	6·4 W	5·4 S	5·6 W	8·1 S	3·3 W	7·6 S	15·1 W	5·8 S	25·0 W	3·4 S	8·0 W	7·6 N	1·0 W	3·0 N	2·0 E	10·4 N	3·5 W	6·8 N	3·3 W
29 ...	3·0 N	0·6 W	11·4 N	5·7 W	5·2 N	5·2 W	2·5 S	5·8 W	16·5 S	1·1 W	6·6 S	16·0 W	0·9 S	29·4 W	3·7 S	6·0 W	0·2 N	2·0 W	4·4 N	1·0 W	8·5 N	1·6 W	10·4 N	3·7 W
30 ...	7·5 N	0·3 W			1·5 S	3·7 W	5·4 N	7·2 W	4·9 S	5·8 W	5·0 S	16·4 W	5·0 S	25·2 W	7·9 S	4·9 W	1·0 N	1·6 W	8·2 N	1·9 W	3·1 N	1·2 W	12·5 N	2·3 W
31 ...	6·5 N	0·8 W			3·2 S	4·1 W			0·0	8·0 W			2·2 S	25·5 W	7·7 S	3·2 W			8·4 N	0·6 W			9·8 N	1·0 W
Monthly Mean ...	4·3 N	0·2 E	8·2 N	3·6 W	6·5 N	5·4 W	2·2 N	5·6 W	0·6 S	6·6 W	6·9 S	8·2 W	4·1 S	19·1 W	3·3 S	13·8 W	1·4 N	5·5 W	4·0 N	2·2 W	3·9 N	0·9 W	6·8 N	0·2 W
Annual Variation ...	2·4 N	6·1 E	6·3 N	2·3 E	4·6 N	0·5 E	0·3 N	0·3 E	2·5 S	0·7 W	8·8 S	2·3 W	6·0 S	13·2 W	5·2 S	7·9 W	0·5 S	0·4 E	2·1 N	3·7 E	2·0 N	5·0 E	4·9 N	5·7 E

The Velocities of the Mean Components for the year are 1·9 N. and 5·9 W.

Velocity of Wind, 1896.

TABLE VIII.—*Mean Velocity of the Wind, in miles per hour, without regard to the direction from which it blew, for each Day of Bombay Civil Time: also the Mean Monthly Velocity, and its Variation from the Mean of the year.*

1896. Date.	January.	February.	March.	April.	May.	June.	July.	August.	September	October.	November	December.
	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.
1	8·4	11·1	14·4	11·0	10·6	10·9	16·0	18·9	8·2	**5·4**	8·1	6·4
2	8·7	11·2	11·5	9·2	11·6	7·6	15·5	17·6	9·7	8·8	8·8	9·4
3	7·0	12·1	10·8	7·8	7·9	9·0	19·3	22·0	7·8	8·7	8·5	11·2
4	8·5	11·1	9·7	8·1	9·4	7·2	18·7	17·5	7·5	8·7	6·8	8·5
5	**6·5**	12·9	8·6	9·0	10·4	6·6	20·3	18·1	7·2	6·5	5·4	5·9
6	10·4	**18·5**	**6·7**	12·6	8·6	7·7	20·1	14·5	5·7	5·8	**5·2**	8·1
7	9·8	14·4	10·6	**15·8**	8·5	11·1	15·5	16·1	6·5	7·6	7·0	8·7
8	7·5	10·9	10·2	9·6	7·6	13·4	14·7	16·5	7·5	7·3	7·1	7·7
9	9·5	10·5	11·5	10·6	7·5	13·3	15·3	12·6	7·5	8·0	6·9	8·6
10	10·7	**7·0**	12·5	13·9	6·7	14·2	14·2	16·2	8·2	7·6	6·9	11·2
11	8·2	11·7	15·0	14·9	9·2	25·0	21·7	14·8	11·9	**11·2**	7·6	8·2
12	7·5	15·9	10·4	9·5	7·6	12·7	12·0	16·2	**13·4**	9·9	7·2	9·4
13	8·1	10·1	7·1	7·3	7·6	7·2	**9·2**	16·0	9·7	9·0	7·1	10·5
14	7·7	7·9	7·6	**5·4**	8·2	7·8	18·6	17·2	9·0	7·0	6·0	**16·7**
15	7·2	9·1	7·0	6·3	7·5	**5·9**	21·2	**24·9**	11·3	8·6	5·9	14·9
16	11·6	9·5	7·1	8·9	7·5	16·3	20·6	23·2	8·9	8·0	9·1	13·2
17	**12·1**	11·4	7·8	11·1	**5·5**	18·0	18·2	19·5	6·5	5·4	10·1	11·6
18	9·9	7·7	10·7	9·6	8·0	19·8	14·7	18·7	6·0	6·7	13·3	9·4
19	8·0	9·9	12·7	10·0	7·4	21·0	18·7	15·2	7·6	6·7	14·7	9·0
20	8·5	9·0	11·9	8·3	8·7	22·0	16·9	14·4	6·5	7·5	**27·1**	8·3
21	6·8	8·8	12·0	13·0	9·0	25·2	22·5	13·2	8·5	5·9	16·4	11·0
22	7·1	8·9	10·7	10·6	8·1	**25·8**	23·2	13·6	8·5	5·4	10·0	6·9
23	7·6	7·2	**16·0**	8·6	7·7	19·0	21·4	11·1	10·5	8·9	11·1	8·8
24	8·3	7·3	15·5	5·6	8·6	14·6	24·2	9·5	9·8	10·8	11·0	11·3
25	7·5	10·0	12·1	6·5	6·1	14·9	**36·4**	10·5	8·4	6·8	7·6	13·8
26	6·8	14·5	7·0	7·6	9·3	20·0	29·2	9·0	**5·6**	6·6	8·0	6·7
27	7·6	9·9	13·9	9·0	13·4	15·2	26·0	8·8	7·5	6·2	8·0	**5·6**
28	8·5	10·5	12·5	8·2	10·6	17·1	26·2	9·2	9·5	7·7	11·9	8·5
29	7·4	13·9	8·0	7·0	**17·7**	17·3	29·6	**7·5**	7·2	6·7	10·0	12·0
30	10·2		7·5	10·2	9·7	17·5	26·2	10·2	6·9	10·4	6·4	13·4
31	8·6		9·7		8·0		25·9	10·7		9·9		10·9
Monthly Mean .	8·5	10·8	10·6	9·5	8·8	14·8	**20·4**	14·9	8·3	**7·7**	9·3	9·9
Annual Variation	—2·6	—0·3	—0·5	—1·6	—2·3	+3·7	+9·3	+3·8	—2·8	—3·4	—1·8	—1·2

	Miles.
The Mean Velocity for June to August	16·7
The Mean Velocity for September to May	9·3
The Mean Velocity for the year	11·1
The greatest monthly mean (that of July)	20·4
The least monthly mean (that of October)	7·7
Difference = ...	12·7
The greatest Mean daily Velocity of Wind in the year (that of 25th July) was	36·4
The least do. do. do. (that of 6th November) was ...	5·2
Difference = ...	31·2

Aggregate and Mean Velocities and Relative Frequency of Different Winds, 1896.

TABLE IX.—*Showing, for the year 1896, the sums of the Velocities, and the Mean Velocities, in miles per hour, of the Winds which blew in each Month, from each of the sixteen Principal Directions: and also the number of hourly Observations which those sums comprise; the latter numbers indicating the Relative frequency of the same Wind (as to direction) in the several Months, and of different Winds during the same Month.*

1896.	N.			N.N.E.			N.E.			E.N.E.			E.			E.S.E.			S.E.			S.S.E.		
Month.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.
	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.
January ...	515	80	6·4	404	58	7·0	368	50	7·4	1,229	146	8·4	473	68	7·0	185	23	8·0	61	8	7·6	65	8	8·1
February ...	1,446	170	8·5	320	49	6·5	136	25	5·4	289	38	7·6	138	21	6·6	12	2	6·0	23	3	7·7	8	1	8·0
March ...	678	87	7·8	277	42	6·6	112	18	6·2	134	15	8·9	97	16	6·1	6	1	6·0	20	5	4·0	36	3	12·0
April ...	362	43	8·4	97	16	6·1	88	19	4·6	30	5	6·0	35	7	5·0	22	6	3·7	52	9	5·8	146	17	8·6
May ...	36	8	4·5	17	3	5·7	31	5	6·2	0	0	0·0	6	1	6·0	12	2	6·0	30	3	10·0	212	17	12·5
June... ...	52	8	6·5	44	8	5·5	40	7	5·7	41	6	6·8	90	13	6·9	49	5	9·8	244	28	8·7	784	55	14·3
July ...	8	1	8·0	6	1	6·0	20	3	6·7	0	0	0·0	24	2	12·0	9	1	9·0	24	3	8·0	23	3	7·7
August ...	0	0	0·0	0	0	0·0	0	0	0·0	0	0	0·0	0	0	0·0	0	0	0·0	0	0	0·0	87	6	14·5
September ...	97	15	6·5	81	16	5·1	103	18	5·7	152	23	6·6	120	16	7·5	84	15	5·6	55	10	5·5	42	8	5·2
October ...	340	55	6·2	113	20	5·6	343	51	6·7	366	56	6·5	298	43	6·9	198	37	5·4	48	9	5·3	23	3	7·7
November ...	880	127	6·9	131	19	6·9	558	74	7·5	484	60	8·1	340	26	13·1	363	28	13·0	42	3	14·0	38	3	12·7
December ...	1,093	144	7·6	350	53	6·6	505	68	7·4	1,098	107	10·3	461	47	9·8	57	9	6·3	6	1	6·0	0	0	0·0
Year ...	5,507	738	7·5	1,840	285	6·5	2,304	338	6·8	3,823	456	8·4	2,082	260	8·0	997	129	7·7	605	82	7·4	1,464	124	11·8

1896.	S.			S.S.W.			S.W.			W.S.W.			W.			W.N.W.			N.W.			N.N.W.			No. of Observations.		No. of hours.
Month.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Calm	Variable.	Record lost.
	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.			
January ...	0	0	0·0	0	0	0·0	9	2	4·5	23	4	5·7	444	54	8·2	709	84	8·4	883	87	10·1	928	72	12·9	0	0	0
February ...	0	0	0·0	0	0	0·0	0	0	0·0	0	0	0·0	132	15	8·8	449	46	9·8	2,692	196	13·7	1,873	130	14·4	0	0	0
March ...	73	7	10·4	73	9	8·1	34	9	3·8	113	16	7·1	312	43	7·3	1,556	150	10·4	2,780	211	13·2	1,589	112	14·2	0	0	0
April ...	240	18	13·3	448	52	8·6	283	46	6·2	614	72	8·5	867	110	7·9	1,171	111	10·5	1,542	122	12·6	838	64	13·1	2	1	0
May ...	506	28	18·1	342	39	8·8	391	48	8·1	714	86	8·3	1,957	261	7·5	1,815	185	9·8	420	49	8·6	94	9	10·4	0	0	0
June ...	1,192	55	21·7	1,176	75	15·7	1,251	75	16·7	3,735	226	16·5	1,166	76	15·3	592	61	9·7	136	17	8·0	50	5	10·0	0	0	0
July ...	58	6	9·7	57	7	8·1	332	24	13·8	7,462	385	19·4	6,693	281	23·8	409	20	20·4	25	5	5·0	24	2	12·0	0	0	0
August ...	92	7	13·1	144	15	9·6	512	48	10·7	4,852	328	14·8	5,293	331	16·0	142	9	15·8	0	0	0·0	0	0	0·0	0	0	0
September ...	169	23	7·3	134	15	8·9	62	9	6·9	443	53	8·4	2,015	216	9·3	1,357	171	7·9	916	97	9·4	154	15	10·3	0	0	0
October ...	74	12	6·2	23	3	7·7	51	9	5·7	42	5	8·4	120	16	7·5	1,095	117	9·4	1,741	201	8·7	884	104	8·5	3	0	0
November ...	520	17	30·6	28	3	9·3	58	5	11·6	167	22	7·6	185	13	14·2	620	72	8·6	1,226	140	8·8	1,067	107	10·0	1	0	0
December ...	0	0	0·0	11	6	1·8	5	1	5·0	9	1	9·0	15	2	7·5	492	51	9·6	1,302	114	11·4	1,934	139	13·9	1	0	0
Year ...	2,924	173	16·9	2,436	224	10·9	2,988	276	10·8	18,174	1,198	15·2	19,199	1,418	13·5	10,407	1,077	9·7	13,663	1,239	11·0	9,435	759	12·4	7	1	0

Temperature of the Ground, 1896.

TABLE X.—*Showing, for each Month, the Mean Temperature of the Ground, and its Annual Variation, at the respective depths of 1, 9, 20, 60 and 132 inches below the surface.*

DEPTH.	1 INCH.		9 INCHES.		20 INCHES.		60 INCHES.		132 INCHES.	
Month.	Mean Temperature.	Excess over the yearly Mean.	Mean Temperature.	Excess over the yearly Mean.	Mean Temperature.	Excess over the yearly Mean.	Mean Temperature.	Excess over the yearly Mean.	Mean Temperature.	Excess over the yearly Mean.
	°	°	°	°	°	°	°	°	°	°
January ...	78·2	—4·4	78·6	—3·9	81·3	—3·2	83·3	—1·5	83·2	—0·8
February ...	77·6	—5·0	77·9	—4·6	80·5	—4·0	82·6	—2·2	82·6	—1·4
March	81·5	—1·1	80·7	—1·8	81·9	—2·6	82·4	—2·4	82·4	—1·6
April	86·2	+3·6	84·9	+2·4	85·5	+1·0	84·2	—0·6	83·1	—0·9
May	87·8	+·52	86·8	+4·3	87·5	+3·0	86·0	+1·2	83·8	—0·2
June	85·0	+2·4	85·6	+3·1	87·8	+3·3	87·4	+2·6	84·7	+0·7
July	82·1	—0·5	83·4	+0·9	86·0	+1·5	86·7	+1·9	85·3	+1·3
August... ...	81·0	—1·6	81·7	—0·8	84·1	—·04	85·3	+0·5	85·2	+1·2
September ...	83·2	+0·6	82·8	+0·3	84·3	—0·2	84·5	—0·3	84·5	+0·5
October ...	85·3	+2·7	84·6	+2·1	85·7	+1·2	84·9	+0·1	84·3	+0·3
November ...	83·0	+0·4	83·1	+0·6	85·4	+0·9	85·4	+0·6	84·3	+0·3
December ...	80·0	—2·6	80·6	—1·9	83·6	—0·9	85·0	+0·2	84·1	+0·1
Year ...	82·6		82·5		84·5		84·8		84·0	

Extent of Cloudy Sky, 1896.

TABLE XI.—*Means of Estimations made at 6, 10, 14, 16 and 22 hours daily, the whole Sky being reckoned as 10.*

1896. Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1	0·2		1·6	1·0		5·8	7·2	**10·0**	7·8	3·0	0·6	5·2
2	1·0		**4·6**	5·6	0·6	8·8	9·4	9·6	8·2	**3·4**		0·4
3			1·6	3·6	1·0	9·8	8·8	10·0	6·8	3·2		
4	1·2			5·4	1·2	8·0	9·2	9·6	3·6	3·0		0·2
5				0·6	1·8	9·0	9·0	7·0	5·6	1·6	1·2	2·0
6	0·2		0·2		6·0	7·2	9·0	7·6	5·2	2·2	1·0	2·6
7	0·2		0·2	2·4	4·4	7·8	**10·0**	9·4	6·4	0·4		
8			1·0	6·6	3·6	6·4	9·0	10·0	3·8	0·4		
9			1·8	**9·0**	2·4	7·6	**5·0**	10·0	2·6	0·2		
10			0·2	7·2	2·4	**5·2**	7·8	9·6	4·2		0·2	
11				1·0	1·0	8·0	7·8	10·0	5·2		3·6	
12					0·8	8·2	9·8	10·0	4·8		3·2	
13			1·0	0·6	1·2	7·4	10·0	10·0	6·6	1·0	0·8	
14	**1·4**			0·6	3·4	8·4	10·0	9·4	8·0	0·4	6·4	1·0
15		0·4	0·6	2·2	3·8	7·4	9·4	10·0	3·2		5·4	0·4
16		2·8		1·0	3·2	8·8	9·2	10·0	2·8	1·6	0·2	3·8
17		2·0		1·2	2·8	**10·0**	8·8	7·4	2·8	2·0	1·6	8·2
18		1·0	0·8		2·2	9·8	9·8	10·0	2·6		8·4	3·2
19	0·2		1·4		1·8	10·0	10·0	8·8	3·2		**10·0**	4·4
20					2·4	10·0	10·0	9·4	2·4		6·4	6·0
21			0·4		2·0	10·0	9·4	9·8	4·4	0·8	7·0	**8·6**
22			2·2		3·6	10·0	10·0	10·0	3·6	1·2	4·4	1·4
23		1·0	3·6		4·0	9·4	9·8	9·2	5·6	0·6	3·8	4·4
24		1·0	3·0	0·6	5·8	6·8	10·0	8·6	5·6	1·2	0·6	3·4
25		5·8			1·2	7·2	10·0	8·0	**9·4**	0·4	2·2	2·8
26		**8·6**	0·6	4·0	2·2	9·8	10·0	7·4	6·2		4·0	4·0
27		7·8		3·2	2·4	9·6	10·0	7·6			1·0	2·6
28	0·4	5·2	1·2	4·0	4·6	10·0	10·0	5·6	1·4	2·0	5·0	8·4
29	1·0	0·4	0·8	2·4	5·8	9·8	10·0	6·6	5·4	3·0	4·8	2·8
30			0·2	0·4	**6·6**	10·0	10·0	**3·6**	3·2	3·4	3·2	0·2
31					6·2		10·0	7·6				0·2
Monthly Mean.	**0·2**	1·2	0·9	2·1	2·9	8·5	**9·3**	8·8	4·7	1·1	2·8	2·5
Annual Variation.	—3·5	—2·5	—2·8	—1·6	—0·8	+4·8	+5·6	+5·1	+1·0	—2·6	—0·9	—1·2

For the days which have no entry, 0·0 is to be understood.

Mean of the months from January to April, November and December ... ... 1·6

Mean of the months from May to October ... ... 5·9

Mean for the year ... ... 3·7

Rainfall, 1896.

TABLE XII.—*Total Fall of Rain (in inches) as measured by Newman's Gauge, placed 4½ feet above the ground.*

1896.	MONTH.											
Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
					in.	in.	in.	in.	in.	in.	in.	
1	...	...	...	...	...	0·07	0·05	0·49	...	...	...	...
2	...	...	...	...	...	0·32	1·09	0·62	...	0·01	...	...
3	...	...	...	...	...	1·55	0·06	0·52	...	...	...	...
4	...	...	...	...	...	2·22	3·72	2·33	...	...	...	...
5	...	...	...	...	...	0·82	0·06	0·08	...	...	...	...
6	...	...	...	...	...	0·23	0·05	0·02	...	...	...	...
7	...	...	...	...	...	...	0·07	0·05	0·59	...	...	...
8	...	...	...	...	...	0·05	0·21	1·09	...	...	...	...
9	...	...	...	...	...	0·02	0·02	1·91	...	...	...	...
10	...	...	...	...	...	...	1·76	2·57	0·02	...	...	...
11	...	...	...	...	...	...	0·31	0·73	0·09	...	...	...
12	...	...	...	...	...	0·85	2·86	1·38	...	...	...	...
13	...	...	...	...	...	0·02	2·03	0·57	0·07	...	...	...
14	...	...	...	...	...	0·82	1·58	2·75	0·30	...	...	...
15	...	...	...	...	...	0·09	1·98	2·85	0·03	...	...	...
16	...	...	...	...	...	1·52	0·34	0·71	...	...	...	...
17	...	...	...	...	...	2·63	0·08	0·18	...	...	...	...
18	...	...	...	...	0·05	1·47	0·56	0·16	0·19	...	...	...
19	...	...	...	...	..	1·68	1·12	0·06	...	...	0·12	...
20	...	...	...	...	...	2·48	2·47	0·31	...	...	...	...
21	...	...	...	...	...	2·96	0·79	0·01	0·01	...	0·24	...
22	...	...	...	...	...	6·21	1·30	0·25	...	...	...	...
23	...	...	...	...	...	0·80	0·51	0·01	...	...	...	...
24	...	...	...	...	...	0·06	1·84	0·08	...	...	...	...
25	...	...	...	...	...	0·11	2·39	0·14	0·32	...	...	...
26	...	...	...	...	...	0·61	0·54	...	...	...	...	...
27	...	...	...	...	...	0·04	0·42	0·14	...	...	...	...
28	...	...	...	...	0·21	0·03	2·07	...	...	...	0·17	...
29	...	...	...	...	...	0·08	3·92	0·17	...	...	...	...
30	...	...	...	...	...	0·28	1·81	0·52	...	...	...	...
31	...	...	...	...	...	...	0·43	0·07	...	...	...	...
Monthly Total.	...	...	...	...	0·26	28·02	36·44	20·77	1·62	0·01	0·53	...
Number of rainy days	...	...	...	...	2	27	31	29	9	1	3	...

Total fall of rain in the year ... ... 87·65 inches.
Total number of rainy days in the year 102
The greatest daily fall of rain in the year (that of 22nd June) was ... ... 6·21 inches.
No rain fell in the months of January, February, March, April and December, nor on any of the days left blank in the above table.

Table XIII.—Five-day Means, 1896.

Number of Five-day Period.	Barometric Pressure.	Temperature of the Air.	Pressure of Vapour.	Additional Capacity of the Air.	*Rainfall.	North or South Component of Wind.	East or West Component of Wind.	Number of Five-day Period.	Barometric Pressure.	Temperature of the Air.	Pressure of Vapour.	Additional Capacity of the Air.	*Rainfall.	North or South Component of Wind.	East or West Component of Wind.
	In.	°	In.	In.	In.	Miles.	Miles.		In.	°	In.	In.	In.	Miles.	Miles.
1	29·930	77·0	0·675	0·260		4·5 N.	0·1 E.	38	29·730	82·9	0·934	0·191	0·41	2·8 S.	16·6 W.
2	·973	75·9	·590	·314		5·0 N.	1·3 E.	39	·654	80·2	·905	·127	8·54	2·2 S.	12·2 W.
3	·951	76·1	·615	·292		3·0 N.	1·4 E.	40	·748	81·4	·915	·156	4·08	5·6 S.	17·5 W.
4	·949	74·6	·574	·289		7·5 N.	1·1 W.	41	·693	80·0	·897	·128	6·91	4·8 S.	20·4 W.
5	·936	76·1	·658	·247		2·9 N.	0·7 E.	42	·558	79·5	·886	·122	9·34	3·2 S.	28·7 W.
6	·931	75·9	·656	·243		2·2 N.	1·0 W.	43	·598	79·2	·881	·115	3·87	4·4 S.	21·2 W.
7	·958	74·9	·665	·207		9·2 N.	2·5 W.	44	·722	80·0	·892	·134	3·57	2·8 S.	15·9 W.
8	·938	74·1	·587	·261		11·8 N.	4·5 W.	45	·716	78·4	·877	·097	7·16	2·0 S.	14·7 W.
9	·905	75·5	·588	·301		8·6 N.	3·1 W.	46	·706	78·5	·866	·110	6·65	2·5 S.	20·1 W.
10	·922	74·9	·632	·237		7·0 N.	3·7 W.	47	·768	80·0	·871	·152	0·64	5·1 S.	12·1 W.
11	·965	74·5	·616	·242		4·1 N.	3·4 W.	48	·794	80·2	·837	·193	0·36	1·4 S.	9·0 W.
12	·966	77·4	·685	·258		9·5 N.	4·0 W.	49	·787	80·5	·845	·198	0·76	5·9 S.	5·1 W.
13	·855	77·2	·676	·264		6·0 N.	5·2 W.	50	·821	81·0	·825	·236	0·59	0·7 N.	5·5 W.
14	·889	76·8	·689	·236		8·0 N.	5·8 W.	51	·832	81·6	·821	·257	0·11	0·3 N.	9·6 W.
15	·838	78·1	·752	·212		2·8 N.	5·0 W.	52	·803	80·9	·812	·243	0·40	0·1 S.	8·0 W.
16	·813	78·9	·769	·223		7·4 N.	6·3 W.	53	·850	81·6	·829	·252	0·20	3·1 N.	4·7 W.
17	·877	82·6	·755	·362		9·1 N.	5·5 W.	54	·820	81·3	·894	·177	0·32	4·5 N.	2·1 W.
18	·805	83·1	·833	·303		4·3 N.	4·9 W.	55	·833	84·0	·933	·237	0·01	3·2 N.	2·0 W.
19	·793	83·0	·906	·227		3·0 S.	4·5 W.	56	·801	84·6	·949	·242		2·2 N.	1·5 W.
20	·782	85·2	·809	·409		8·9 N.	5·4 W.	57	·854	82·7	·898	·224		6·3 N.	3·3 W.
21	·746	83·8	·862	·299		3·3 N.	6·3 W.	58	·891	82·5	·929	·183		4·2 N.	4·1 W.
22	·766	83·5	·836	·317		3·6 N.	6·1 W.	59	·907	83·1	·867	·273		1·9 N.	1·1 W.
23	·790	84·5	·887	·303		2·7 N.	5·4 W.	60	·923	83·4	·857	·291		4·3 N.	2·3 W.
24	·775	85·0	·912	·297		2·6 S.	5·8 W.	61	·909	83·4	·744	·407		6·2 N.	0·9 W.
25	·780	84·5	·895	·292		4·4 N.	6·8 W.	62	·873	81·9	·791	·306		5·0 N.	1·4 W.
26	·812	85·5	·925	·299		0·7 S.	7·0 W.	63	·874	82·9	·798	·333		2·8 N.	2·3 W.
27	·805	85·1	·869	·343		0·8 N.	7·8 W.	64	·831	82·4	·755	·359		4·6 N.	0·5 W.
28	·790	86·4	·928	·334	0·05	0·5 S.	7·0 W.	65	·812	82·6	·737	·384	0·36	3·6 S.	4·3 E.
29	·797	86·4	·912	·349		2·2 N.	7·2 W.	66	·875	75·5	·665	·221		7·8 N.	2·8 W.
30	·788	86·8	·958	·322	0·21	9·8 S.	3·3 W.	67	·932	80·1	·807	·226	0·17	6·2 N.	2·3 W.
31	·772	85·0	·955	·256	4·16	1·2 N.	6·7 W.	68	·937	79·5	·724	·289		5·9 N.	1·4 W.
32	·677	85·0	·968	·239	1·12	4·8 S.	1·1 W.	69	·979	78·6	·636	·350		5·8 N.	0·3 W.
33	·658	85·2	·963	·251	1·69	9·1 S.	1·9 W.	70	·959	78·2	·568	·405		6·7 N.	4·7 E.
34	·442	81·6	·949	·131	7·39	13·0 S.	4·2 W.	71	·898	78·0	·620	·347		7·1 N.	0·8 E.
35	·551	81·3	·924	·148	12·51	8·0 S.	18·5 W.	72	·972	77·3	·636	·306		7·5 N.	1·5 W.
36	·644	83·2	·935	·201	0·87	6·9 S.	15·3 W.	73	·982	74·3	·596	·257		8·3 N.	2·8 W.
37	·652	82·2	·926	·175	5·20	6·1 S.	15·8 W.								

* Five-day sums, *not means*.

TABLES OF RESULTS

OF

ABSOLUTE MAGNETICAL OBSERVATIONS,

1896.

B 521—1

Absolute Magnetical Observations.—Table I.

Observations of Vibration and Deflection, taken with the Kew Unifilar Magnetometer (No. 23, by Elliott Brothers), for the determination of Absolute Horizontal Force.

1896.

1896. Date.	Civil Time, Mean.	Magnet N. 23 a. Time of one Vibration.	Effect of 90° Torsion.	Temperature.	Rate of Chronometer.	Corresponding Mean Reading of L. H. F. Magnetometer. Scale Reading.	Thermometer.	Angle of Deflection of Magnet N. 23 c by N. 23 a at Distance. 0·8 foot.	1·0 foot.	Temperature.	Corresponding Mean Reading of L. H. F. Magnetometer. Scale Reading.	Thermometer.	Observer.	Calculated Results in English Units. Values of m.	Values of X. From Deflections at distance. 0·8 foot ($X_{0\cdot8}$)	1·0 foot ($X_{1\cdot0}$)	Difference. $X_{0\cdot8}-X_{1\cdot0}$	Mean. $\frac{X_{0\cdot8}+X_{1\cdot0}}{2}$	Monthly Mean Values of X.	Monthly Mean Values of X in Metrical Units.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
	h. m.	s.	Sc. div.	°	s.		°	° ′ ″	° ′ ″	°		°								
JANUARY 1	12 4	2·8438	0·59	88·8	−14·3	16·16	84·0	17 22 25	8 50 0	88·7	16·01	84·5	V.G.G.	·63517	8·1309	8·1292	+·0017	8·1300		
,, ,,	15 22	2·8441	0·61	85·6	,,	15·38	86·1	17 22 50	8 50 10	87·8	15·68	85·9	V.G.G.	·63513	8·1264	8·1251	+·0013	8·1257		
,, 8	11 41	2·8448	0·57	85·4	−12·6	16·11	80·0	17 23 16	8 50 21	84·8	15·97	80·5	D.	·63470	8·1257	8·1247	+·0010	8·1252		
,, ,,	15 25	2·8450	0·59	85·7	,,	15·41	82·5	17 23 22	8 50 22	85·9	15·73	81·7	D.	·63489	8·1240	8·1231	+·0009	8·1235		
,, 15	12 7	2·8434	0·57	85·9	−12·5	16·79	80·3	17 22 51	8 50 6	85·8	16·50	80·7	N.	·63489	8·1306	8·1300	+·0006	8·1303		
,, ,,	15 29	2·8446	0·61	86·6	,,	15·71	82·7	17 23 17	8 50 15	87·3	15·86	82·1	N.	·63504	8·1247	8·1246	+·0001	8·1246	8·1272	3·7473
,, 22	12 1	2·8439	0·58	84·0	−13·2	16·24	79·2	17 24 26	8 50 47	84·7	16·13	80·3	D.	·63516	8·1227	8·1227	·0000	8·1227		
,, ,,	15 34	2·8440	0·57	83·6	,,	15·65	82·6	17 24 35	8 50 52	86·0	15·84	81·6	D.	·63523	8·1201	8·1203	−·0002	8·1202		
,, 29	12 11	2·8436	0·59	86·0	−13·1	16·78	81·8	17 22 40	8 49 57	85·6	16·74	82·3	V.G.G.	·63489	8·1309	8·1307	+·0002	8·1308		
,, ,,	15 22	2·8437	0·57	85·0	,,	16·51	82·5	17 22 43	8 50 0	86·4	16·59	82·1	V.G.G.	·63489	8·1291	8·1287	+·0004	8·1289		
FEBRUARY 5	12 15	2·8456	0·58	82·7	−12·8	15·77	79·8	17 25 57	8 51 32	82·2	15·64	80·4	D.	·63491	8·1133	8·1135	−·0002	8·1134		
,, ,,	15 34	2·8463	0·59	81·8	,,	15·03	82·2	17 26 31	8 51 47	83·1	15·14	81·6	D.	·63494	8·1076	8·1079	−·0003	8·1077		
,, 12	12 16	2·8430	0·61	83·1	−12·5	16·91	79·2	17 23 50	8 50 30	82·8	16·79	79·8	N.	·63494	8·1285	8·1283	+·0002	8·1284		
,, ,,	15 44	2·8442	0·59	83·9	,,	15·81	81·6	17 24 22	8 50 47	83·5	16·14	81·2	N.	·63508	8·1231	8·1229	+·0002	8·1230	8·1209	3·7444
,, 19	12 25	2·8434	0·63	83·0	−13·0	16·73	79·2	17 24 7	8 50 40	82·8	16·51	79·8	D.	·63488	8·1261	8·1259	+·0002	8·1260		
,, ,,	16 2	2·8453	0·59	81·5	,,	15·56	81·3	17 26 11	8 51 36	83·0	15·53	81·0	D.	·63498	8·1115	8·1119	−·0004	8·1117		
,, 26	12 6	2·8426	0·63	83·7	−13·4	16·89	81·2	17 23 5	8 50 5	83·6	16·81	81·7	N.	·63489	8·1320	8·1322	−·0002	8·1321		
,, ,,	15 42	2·8437	0·61	83·7	,,	16·05	82·5	17 23 55	8 50 32	84·5	16·26	82·3	N.	·63507	8·1251	8·1251	·0000	8·1251		
MARCH 4	12 32	2·8436	0·62	85·4	−12·0	16·60	82·0	17 23 7	8 50 11	84·5	16·64	82·8	D.	·63498	8·1298	8·1294	+·0004	8·1296		
,, ,,	15 38	2·8449	0·59	83·5	,,	15·38	83·8	17 24 32	8 50 50	84·2	15·72	83·5	D.	·63501	8·1193	8·1195	−·0002	8·1194		
,, 11	12 22	2·8431	0·61	83·8	−13·8	16·61	81·5	17 23 25	8 50 20	84·7	16·37	82·0	N.	·63492	8·1285	8·1281	+·0004	8·1283		
,, ,,	15 35	2·8443	0·65	85·0	,,	15·71	83·1	17 23 50	8 50 31	85·2	15·88	82·9	N.	·63502	8·1240	8·1238	+·0002	8·1239	8·1285	3·7479
,, 18	12 26	2·8433	0·72	83·5	−14·4	16·43	81·4	17 22 10	8 49 46	83·8	16·24	81·9	D.	·63445	8·1330	8·1322	+·0008	8·1326		
,, ,,	15 47	2·8438	0·67	82·8	,,	15·76	83·2	17 22 20	8 49 52	84·4	15·93	82·7	D.	·63448	8·1298	8·1289	+·0009	8·1293		
,, 25	12 6	2·8431	0·65	89·3	−15·5	16·63	85·7	17 21 5	8 49 15	89·1	16·23	86·4	N.	·63485	8·1379	8·1369	+·0010	8·1374		
,, ,,	15 27	2·8448	0·66	88·1	,,	15·16	87·6	17 21 58	8 49 42	89·5	15·54	87·3	N.	·63499	8·1281	8·1272	+·0009	8·1276		

1896. Date.	Civil Time, Mean.	Magnet N. 23 *a*. Time of one Vibration.	Effect of 90° Torsion.	Temperature.	Rate of Chronometer.	Corresponding Mean Reading of L. H. F. Magnetometer. Scale Reading.	Thermometer.	Angle of Deflection of Magnet N. 23 *c* by N. 23 *a* at Distance. 0·8-foot.	1·0 foot.	Temperature.	Corresponding Mean Reading of L. H. F. Magnetometer. Scale Reading.	Thermometer.	Observer.	Calculated Results in English Units. Values of m.	Values of X. From Deflections at distance. 0·8 foot ($X_{0\cdot8}$)	1·0 foot ($X_{1\cdot0}$)	Difference. $X_{0\cdot8}-X_{1\cdot0}$	Mean. $\frac{X_{0\cdot8}+X_{1\cdot0}}{2}$	Monthly Mean Values of X.	Monthly Mean Values of X in Metrical Units.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
	h. m.	s.	Sc. div.	°	s.		°	° ′ ″	° ′ ″	°		°								
April 1	12 17	2·8463	0·63	90·4	−14·2	15·63	86·6	17 20 55	8 49 18	90·4	15·41	86·9	D.	·63438	8·1291	8·1272	+·0019	8·1281		
,,	15 31	2·8474	0·63	89·9	,,	14·78	87·6	17 21 27	8 49 36	90·7	14·91	87·4	D.	·63441	8·1233	8·1210	+·0023	8·1221		
,, 8	12 15	2·8455	0·61	92·0	−14·2	15·79	87·9	17 20 45	8 49 10	92·5	15·65	88·4	N.	·63480	8·1315	8·1300	+·0015	8·1307		
,, ,,	15 36	2·8462	0·66	89·7	,,	14·98	88·9	17 21 45	8 49 36	92·6	15·11	88·7	N.	·63486	8·1233	8·1221	+·0012	8·1227		
,, 15	12 26	2·8459	0·58	91·6	−13·6	15·78	87·6	17 21 27	8 49 22	92·0	15·39	88·0	D.	·63469	8·1279	8·1276	+·0003	8·1277		
,, ,,	15 35	2·8469	0·59	91·8	,,	14·72	89·2	17 21 53	8 49 40	92·5	14·94	88·7	D.	·63491	8·1231	8·1221	+·0010	8·1226	8·1245	3·7460
,, 22	12 24	2·8461	0·71	91·1	−12·9	15·24	87·7	17 22 36	8 49 55	90·5	14·89	88·2	N.	·63486	8·1238	8·1236	+·0002	8·1237		
,, ,,	15 46	2·8474	0·68	90·4	,,	14·17	89·4	17 23 5	8 50 14	92·0	14·18	89·1	N.	·63491	8·1163	8·1156	+·0007	8·1159		
,, 29	12 4	2·8453	0·74	92·2	−13·0	15·43	88·7	17 21 2	8 49 15	93·1	15·04	89·0	V. G. G.	·63482	8·1306	8·1294	+·0012	8·1300		
,, ,,	15 14	2·8471	0·75	92·8	,,	14·24	90·1	17 21 47	8 49 35	94·1	14·46	89·8	V. G. G.	·63499	8·1221	8·1214	+·0007	8·1217		
May 6	12 10	2·8451	0·74	91·3	−13·5	15·38	88·8	17 21 5	8 49 16	91·9	15·15	89·1	N.	·63480	8·1311	8·1302	+·0009	8·1306		
,, ,,	15 28	2·8467	0·77	91·4	,,	14·41	89·9	17 21 40	8 49 32	93·7	14·67	89·7	N.	·63497	8·1229	8·1219	+·0010	8·1224		
,, 13	12 20	2·8469	0·72	92·8	−12·0	15·29	89·2	17 20 21	8 48 59	93·9	15·13	89·6	D.	·63451	8·1283	8·1268	+·0015	8·1275		
,, ,,	15 21	2·8475	0·71	92·4	,,	14·38	90·6	17 21 1	8 49 13	95·0	14·61	90·2	D.	·63473	8·1229	8·1219	+·0010	8·1224		
,, 21	12 13	2·8469	0·72	92·6	−13·2	14·79	90·1	17 21 27	8 49 27	92·9	14·66	90·6	N.	·63475	8·1249	8·1240	+·0009	8·1244	8·1243	3·7460
,, ,,	15 25	2·8477	0·72	92·0	,,	13·85	91·4	17 21 56	8 49 40	94·6	14·21	91·1	N.	·63497	8·1188	8·1178	+·0010	8·1183		
,, 27	12 33	2·8474	0·73	93·4	−13·9	14·83	90·0	17 20 32	8 49 7	94·2	14·70	90·6	D.	·63454	8·1262	8·1244	+·0018	8·1253		
,, ,,	15 56	2·8472	0·82	92·4	,,	14·23	91·3	17 20 41	8 49 12	94·6	14·45	91·1	D.	·63470	8·1249	8·1229	+·0020	8·1239		
June 3	13 3	2·8436	0·62	87·6	−14·0	15·80	87·0	17 21 12	8 49 25	87·7	15·72	87·5	N.	·63476	8·1358	8·1341	+·0017	8·1349		
,, ,,	15 34	2·8455	0·65	86·5	,,	15·00	87·9	17 21 44	8 49 42	89·9	15·30	87·7	N.	·63470	8·1253	8·1234	+·0019	8·1243		
,, 10	12 28	2·8465	0·68	90·1	−12·1	14·86	88·1	17 21 12	8 49 34	92·0	14·90	88·5	D.	·63469	8·1259	8·1231	+·0028	8·1245		
,, ,,	15 43	2·8469	0·70	91·0	,,	14·37	89·6	17 21 1	8 49 27	93·9	14·68	89·4	D.	·63483	8·1244	8·1218	+·0026	8·1231	8·1267	3·7471
,, 17	12 6	2·8441	0·62	84·3	−12·5	15·49	84·8	17 23 5	8 50 22	85·2	15·33	84·7	N.	·63475	8·1270	8·1251	+·0019	8·1260		
,, ,,	15 14	2·8462	0·67	86·2	,,	14·69	85·0	17 23 7	8 50 22	86·5	15·25	84·9	N.	·63482	8·1210	8·1193	+·0017	8·1201		
,, 24	12 9	2·8437	0·66	87·5	−12·2	16·15	84·1	17 21 22	8 49 30	88·1	15·96	84·8	V. G. G.	·63478	8·1347	8·1330	+·0017	8·1338		
,, ,,	15 22	2·8453	0·66	88·2	,,	15·28	85·3	17 21 55	8 49 45	88·7	15·58	85·2	V. G. G.	·63483	8·1279	8·1264	+·0015	8·1271		
July 1	12 10	2·8449	0·64	88·5	−13·3	15·57	85·5	17 22 9	8 49 52	88·0	15·47	85·7	N.	·63478	8·1291	8·1276	+·0015	8·1283		
,, ,,	15 14	2·8455	0·65	85·6	,,	15·06	85·8	17 22 55	8 50 12	87·9	15·24	85·9	N.	·63479	8·1219	8·1208	+·0011	8·1213		
,, 8	12 21	2·8447	0·67	85·6	−12·8	15·53	84·8	17 22 57	8 50 15	86·0	15·36	84·9	D.	·63467	8·1259	8·1244	+·0015	8·1258		
,, ,,	15 39	2·8462	0·66	87·8	,,	14·78	85·6	17 22 30	8 50 7	87·8	15·03	85·0	D.	·63467	8·1234	8·1214	+·0020	8·1224		
,, 15	12 21	2·8448	0·70	84·9	−13·8	15·62	83·0	17 22 55	8 50 16	85·4	15·65	83·2	V. G. G.	·63466	8·1257	8·1238	+·0019	8·1247	8·1244	3·7460
,, ,,	15 22	2·8457	0·71	84·7	,,	15·13	83·4	17 23 25	8 50 32	85·1	15·38	83·5	V. G. G.	·63467	8·1212	8·1195	+·0017	8·1203		
,, 22	12 16	2·8445	0·74	84·0	−13·8	15·99	82·3	17 21 27	8 49 44	84·7	15·90	82·7	D.	·63419	8·1319	8·1287	+·0032	8·1303		
,, ,,	15 37	2·8452	0·73	82·8	,,	15·38	83·0	17 21 56	8 49 52	84·6	15·63	83·0	D.	·63421	8·1272	8·1247	+·0025	8·1259		
,, 29	12 18	2·8440	0·73	81·3	−13·9	16·06	81·4	17 23 47	8 50 45	80·7	15·95	81·2	V. G. G.	·63442	8·1259	8·1236	+·0023	8·1247		
,, ,,	15 20	2·8447	0·73	79·9	,,	15·71	80·9	17 23 52	8 50 47	80·7	15·84	80·9	V. G. G.	·63434	8·1221	8·1201	+·0020	8·1211		

August	5	12	57	2·8447	0·74	84·7	—14·4	15·88	81·9	17	22	18	8	50	2	84·6	15·76	82·3	D.	·63438	8·1287	8·1262	+·0025	8·1274		
„	„	15	46	2·8463	0·74	85·0	„	14·94	83·0	17	23	8	8	50	20	85·6	15·32	82·8	D.	·63453	8·1203	8·1190	+·0013	8·1196		
„	12	12	2	2·8455	0·65	84·0	—13·5	15·60	80·9	17	23	33	8	50	35	83·3	15·47	81·3	N.	·63442	8·1225	8·1208	+·0017	8·1216		
„	„	15	15	2·8456	0·74	82·5	„	15·26	81·5	17	24	35	8	51	5	82·8	15·32	81·6	N.	·63463	8·1175	8·1158	+·0017	8·1166		
„	19	12	11	2·8443	0·69	84·5	—13·4	15·93	81·9	17	20	47	8	49	24	84·7	15·84	82·2	D.	·63407	8·1354	8·1322	+·0032	8·1338	8·1244	3·7460
„	„	15	38	2·8458	0·75	83·8	„	15·09	82·8	17	21	20	8	49	47	84·8	15·50	82·8	D.	·63412	8·1285	8·1244	+·0041	8·1264		
„	26	12	14	2·8456	0·60	86·4	—14·2	15·44	83·2	17	21	10	8	49	38	86·3	15·29	83·8	N.	·63416	8·1306	8·1272	+·0034	8·1289		
„	„	15	37	2·8460	0·65	85·1	„	14·79	85·0	17	22	38	8	50	16	86·9	14·89	84·9	N.	·63451	8·1221	8·1193	+·0028	8·1207		
Sept.	2	13	37	2·8462	0·69	87·9	—14·5	15·81	84·0	17	22	35	8	50	7	87·5	15·06	84·4	D.	·63457	8·1233	8·1216	+·0017	8·1224		
„	„	16	0	2·8456	0·66	86·0	„	15·00	84·8	17	22	30	8	50	7	87·1	15·05	84·7	D.	·63457	8·1242	8·1221	+·0021	8·1231		
„	9	12	4	2·8444	0·73	88·2	—15·6	15·97	84·6	17	21	21	8	49	13	87·6	15·81	84·9	N.	·63450	8·1332	8·1335	−·0003	8·1333		
„	„	15	21	2·8457	0·77	86·8	„	14·97	85·5	17	22	12	8	49	43	88·7	15·21	85·3	N.	·63460	8·1242	8·1238	+·0004	8·1240		
„	16	12	9	2·8460	0·68	88·1	—12·5	15·33	84·0	17	22	30	8	49	57	86·8	15·24	84·5	D.	·63454	8·1255	8·1246	+·0009	8·1250		
„	„	15	39	2·8463	0·73	86·0	„	14·87	85·2	17	22	5	8	49	52	86·9	15·11	85·0	D.	·63435	8·1242	8·1223	+·0019	8·1232	8·1234	3·7455
„	23	12	9	2·8466	0·75	87·6	—12·9	14·71	85·3	17	23	28	8	50	20	86·6	14·58	85·7	N.	·63456	8·1195	8·1193	+·0002	8·1194		
„	„	15	18	2·8470	0·78	86·0	„	14·18	86·2	17	23	40	8	50	27	87·0	14·38	86·1	N.	·63459	8·1158	8·1156	+·0002	8·1157		
„	30	12	32	2·8463	0·76	90·0	—14·4	14·91	87·9	17	21	37	8	49	25	90·0	14·73	88·1	D.	·63445	8·1262	8·1261	+·0001	8·1261		
„	„	15	45	2·8469	0·78	88·6	„	14·12	89·1	17	21	50	8	49	37	89·8	14·35	88·7	D.	·63445	8·1227	8·1219	+·0008	8·1223		
Oct.	7	12	6	2·8452	0·84	90·7	—16·4	15·22	88·7	17	20	20	8	48	56	90·6	15·09	89·0	N.	·63445	8·1339	8·1326	+·0013	8·1332		
„	„	15	30	2·8470	0·89	90·5	„	14·37	90·1	17	20	34	8	49	1	91·2	14·65	89·7	N.	·63428	8·1270	8·1259	+·0011	8·1264		
„	14	12	1	2·8471	0·83	90·5	—14·3	14·58	86·7	17	22	6	8	49	57	90·1	14·43	87·1	D.	·63456	8·1225	8·1201	+·0024	8·1213		
„	„	15	37	2·8472	0·87	88·6	„	14·04	88·0	17	22	10	8	50	2	90·6	14·19	87·6	D.	·63456	8·1197	8·1169	+·0028	8·1183		
„	21	12	12	2·8456	0·88	89·9	—14·9	15·05	87·9	17	21	6	8	49	17	90·1	14·85	88·3	N.	·63447	8·1298	8·1287	+·0011	8·1292	8·1262	3·7468
„	„	15	26	2·8472	0·92	89·9	„	14·18	89·2	17	21	50	8	49	42	91·5	14·23	89·1	N.	·63453	8·1210	8·1195	+·0015	8·1202		
„	28	12	16	2·8459	0·91	92·0	—13·4	15·59	87·6	17	19	52	8	48	47	91·3	15·42	88·2	V. G. G.	·63434	8·1345	8·1324	+·0021	8·1334		
„	„	15	16	2·8469	0·93	90·9	„	14·41	89·8	17	20	15	8	48	56	92·2	14·83	89·3	V. G. G.	·63441	8·1281	8·1266	+·0015	8·1273		
Nov.	3	12	8	2·8448	0·92	88·7	—12·4	15·77	86·5	17	21	20	8	49	23	88·8	15·64	86·9	N.	·63459	8·1317	8·1306	+·0011	8·1311		
„	„	15	19	2·8464	0·97	88·5	„	14·84	88·6	17	21	31	8	49	31	90·5	15·17	88·0	N.	·63454	8·1244	8·1231	+·0013	8·1237		
„	11	11	50	2·8471	0·94	92·4	—13·1	14·83	88·1	17	21	8	8	49	27	92·4	14·67	88·6	D.	·63457	8·1255	8·1233	+·0022	8·1244		
„	„	15	23	2·8475	0·89	91·9	„	14·24	89·9	17	21	17	8	49	30	93·8	14·42	89·7	D.	·63470	8·1221	8·1201	+·0020	8·1211	8·1264	3·7469
„	18	11	51	2·8459	1·02	90·1	—12·1	15·66	86·9	17	20	56	8	49	8	90·9	15·46	87·4	N.	·63441	8·1291	8·1283	+·0008	8·1287		
„	„	15	16	2·8487	1·05	92·9	„	14·18	88·4	17	21	44	8	49	32	93·5	14·49	88·0	N.	·63459	8·1178	8·1173	+·0005	8·1175		
„	25	12	5	2·8423	1·00	83·8	—12·9	16·63	80·1	17	22	12	8	50	2	83·6	16·49	80·9	D.	·63478	8·1358	8·1332	+·0026	8·1345		
„	„	15	38	2·8432	1·08	83·9	„	15·64	84·1	17	22	18	8	50	7	84·6	16·06	82·5	D.	·63476	8·1319	8·1289	+·0030	8·1304		
Dec.	2	12	13	2·8461	0·92	90·2	—14·1	15·25	86·4	17	21	57	8	49	35	88·3	15·10	86·7	N.	·63448	8·1272	8·1270	+·0002	8·1271		
„	„	15	18	2·8466	0·84	88·1	„	14·78	87·8	17	22	15	8	49	45	89·4	14·82	87·3	N.	·63444	8·1218	8·1214	+·0004	8·1216		
„	9	12	1	2·8458	0·71	88·5	—12·5	15·78	84·0	17	21	15	8	49	22	88·8	15·58	84·6	D.	·63435	8·1292	8·1281	+·0011	8·1286		
„	„	15	33	2·8475	0·76	88·8	„	14·59	86·5	17	22	12	8	49	56	89·6	14·97	85·8	D.	·63453	8·1203	8·1184	+·0019	8·1193		
„	16	12	2	2·8452	0·85	86·0	—10·4	15·99	82·2	17	22	15	8	49	46	86·7	15·93	82·8	N.	·63453	8·1274	8·1270	+·0004	8·1272		
„	„	15	17	2·8462	0·90	85·0	„	15·31	85·0	17	22	30	8	49	55	88·5	15·66	84·1	N.	·63448	8·1203	8·1197	+·0006	8·1200	8·1251	3·7463
„	23	12	2	2·8446	0·84	88·3	—12·6	16·13	83·7	17	21	15	8	49	27	88·4	15·94	84·1	D.	·63456	8·1326	8·1307	+·0019	8·1316		
„	„	15	14	2·8460	0·83	88·0	„	15·05	86·3	17	21	45	8	49	47	89·6	15·32	85·7	D.	·63464	8·1255	8·1231	+·0024	8·1243		
„	30	12	16	2·8437	0·86	82·0	—11·7	16·75	78·1	17	23	20	8	50	37	81·0	16·53	78·9	V. G. G.	·63448	8·1289	8·1261	+·0028	8·1275		
„	„	15	17	2·8430	0·86	79·0	„	16·20	80·1	17	23	52	8	50	57	81·3	16 26	79·8	V. G. G.	·63469	8·1259	8·1225	+·0034	8·1242		
The mean value of the Horizontal Force for the year 1896 = 8·1252																										3·7463

Absolute Magnetical Observations.—Table II.

Observations of Absolute Declination.

1896.

1896. Date.	Bombay Civil Time.	Mean Readings. Collimator Magnet. Scale apparently Erect.	Inverted.	Horizontal Circle with Telescope pointed to. Scale of Collimator Magnet.	Tárdeo Chimney.	Torsion. Mean.	Effect of 90°.	Observer.	Corresponding Reading of Large Declination Magnetometer.	Absolute Easterly Declination corrected for Torsion.	Monthly Mean. Corresponding Reading of Large Declination Magnetometer.	Absolute Easterly Declination.
1	2	3	4	5	6	7	8	9	10	11	12	13
	h. m.	Sc. div.	Sc. div.	° ′ ″	° ′ ″	°	Sc. div.		Sc. div.	° ′ ″	Sc. div.	° ′ ″
JAN. 2	11 37	+1·52	+1·59	17 3 52	196 55 0	0		N.	33·70	0 35 14		
„ 9	11 26	+1·50	+1·65	17 2 55	196 55 15	10 W	0·77	D.	33·56	0 34 8		
„ 16	11 40	+1·52	+1·56	17 4 30	196 54 50	0		N.	33·88	0 36 3	33·73	0 35 12
„ 23	11 33	+1·52	+1·52	17 2 35	196 54 55	0		D.	33·58	0 34 6		
„ 30	11 35	+1·51	+1·55	17 4 55	196 54 50	0		V.G.G.	33·94	0 36 28		
FEB. 6	11 44	+1·51	+1·66	17 4 35	196 55 5	0		D.	33·82	0 35 46		
„ 13	11 39	+1·52	+1·60	17 3 45	196 54 30	0		N.	33·79	0 35 35		
„ 20	11 30	+1·52	+1·54	17 1 55	196 54 10	0		D.	33·61	0 34 10	33·71	0 35 0
„ 27	11 33	+1·52	+1·57	17 2 45	196 54 40	0		N.	33·64	0 34 28		
MARCH 5	11 43	+1·60	+1·57	17 1 10	196 53 55	0		D.	33·51	0 33 42		
„ 12	11 36	+1·62	+1·45	17 3 5	196 54 25	0		N.	33·78	0 35 17		
„ 19	11 33	+1·57	+1·65	17 2 15	196 54 0	5 W	0·72	D.	33·70	0 34 40	33·61	0 34 13
„ 26	11 34	+1·51	+1·62	17 0 50	196 53 55	0		N.	33·44	0 33 14		
APRIL 2	11 37	+1·54	+1·64	17 2 40	196 54 20	0		D.	33·69	0 34 39		
„ 9	11 41	+1·56	+1·59	17 0 15	196 54 15	0		N.	33·33	0 32 25		
„ 16	11 17	+1·47	+1·71	17 1 27	196 54 15	0		V.G.G.	33·48	0 33 21	33·51	0 33 34
„ 23	11 34	+1·55	+1·56	17 0 30	196 53 35	0		N.	33·46	0 33 21		
„ 30	11 34	+1·54	+1·64	17 0 20	196 52 40	5 W	0·67	D.	33·58	0 34 4		
MAY 7	11 44	+1·59	+1·47	16 58 20	196 52 55	0		N.	33·22	0 31 59		
„ 14	11 41	+1·51	+1·66	16 59 50	196 53 10	0		D.	33·30	0 32 56		
„ 22	11 23	+1·51	+1·72	17 0 32	196 52 50	0		N.	33·50	0 33 54	33·40	0 33 19
„ 28	11 26	+1·52	+1·67	17 1 15	196 53 5	0		D.	33·59	0 34 26		
JUNE 4	11 47	+1·54	+1·55	16 59 50	196 53 7	0		N.	33·38	0 33 9		
„ 11	11 40	+1·52	+1·59	17 1 0	196 53 20	0		D.	33·51	0 34 2		
„ 18	11 44	+1·50	+1·59	17 1 27	196 53 35	0		N.	33·51	0 34 12	33·46	0 33 51
„ 25	11 31	+1·54	+1·69	17 1 7	196 53 12	10 E	0·71	D.	33·44	0 34 0		
JULY 2	11 33	+1·51	+1·60	17 2 0	196 53 12	0		N.	33·61	0 35 8		
„ 9	11 25	+1·50	+1·59	16 59 15	196 53 0	10 E	0·78	D.	33·15	0 32 23		
„ 16	11 33	+1·52	+1·60	16 59 35	196 52 40	0		N.	33·30	0 33 15	33·38	0 33 39
„ 23	11 25	+1·51	+1·67	17 0 25	196 52 45	0		D.	33·42	0 33 55		
„ 30	11 26	+1·52	+1·50	16 59 20	196 52 15	0		N.	33·40	0 33 32		
AUG. 6	11 27	+1·57	+1·54	16 59 40	196 53 45	0		D.	33·21	0 32 22		
„ 13	11 32	+1·52	+1·66	17 0 35	196 53 40	10 W	0·64	N.	33·39	0 33 21		
„ 20	11 31	+1·51	+1·61	16 59 27	196 53 55	0		D.	33·20	0 31 51	33·28	0 32 51
„ 27	11 38	+1·54	+1·61	17 0 0	196 52 30	0		N.	*33·33	0 33 52		
SEPT. 3	11 36	+1·57	+1·52	16 59 50	196 54 5	0		D.	33·22	0 32 14		
„ 11	11 35	+1·52	+1·61	17 0 30	196 53 50	0		N.	33·18	0 33 0		
„ 17	11 46	+1·57	+1·70	17 1 30	196 54 30	0		D.	33·23	0 33 18	33·25	0 33 1
„ 24	11 56	+1·55	+1·59	17 1 0	196 53 52	0		N.	33·36	0 33 31		
OCT. 1	11 31	+1·50	+1·61	17 0 10	196 54 45	0		V.G.G.	33·22	0 31 44		
„ 8	11 34	+1·52	+1·57	17 0 50	196 54 25	0		N.	33·44	0 32 48		
„ 16	11 28	+1·56	+1·46	17 1 0	196 52 25	7 W	0·64	D.	33·55	0 35 15	33·41	0 33 22
„ 22	11 31	+1·56	+1·56	16 59 40	196 52 35	0		N.	33·41	0 33 31		
„ 29	11 26	+1·47	+1·66	16 59 30	196 52 15	5 W	0·65	D.	33·42	0 33 34		
NOV. 6	11 9	+1·57	+1·56	17 1 5	196 52 30	5 W	0·69	N.	33·61	0 35 6		
„ 12	11 34	+1·52	+1·55	16 59 30	196 52 47	0		D.	33·44	0 33 8		
„ 19	11 33	+1·56	+1·51	17 0 0	196 53 25	0		N.	33·33	0 33 4	33·45	0 33 46
„ 26	11 21	+1·55	+1·55	17 0 5	196 52 45	0		D.	33·44	0 33 46		
DEC. 3	11 48	+1·52	+1·59	17 0 50	196 53 17	0		N.	33·47	0 33 55		
„ 10	11 26	+1·52	+1·59	16 59 50	196 53 22	0		D.	33·36	0 32 50		
„ 17	11 40	+1·51	+1·64	17 1 30	196 53 32	0		N.	33·45	0 34 16	33·38	0 33 20
„ 24	11 53	+1·52	+1·60	17 0 30	196 53 35	0		N.	33·38	0 33 15		
„ 31	11 36	+1·51	+1·60	16 59 40	196 53 35	0		G.S.J.	33·25	0 32 25		

The Mean Declination for the year 1896 = 0 33 46

* From the 27th of August Grubb's Declination went out of order and was under adjustment. The Magnetograph tabulations of the rest of the year have therefore been taken and duly converted into Grubb's scale by a factor obtained from comparison of the scale readings of the two instruments, and the calculated readings so obtained have been substituted.

Absolute Magnetical Observations.—Table III.

OBSERVATIONS OF INCLINATION, 1896.

Taken with Barrow's Dip Circle, with Microscopes, No. 49 and two 3½-inch Needles, Nos. 1 and 2, by Dover, Charlton.

1896. Date.	Bombay Civil Time (0 to 24 hours). At commencement.	At conclusion.	Observer.	Needle marked.	End of Needle Dipping. A. Face of Circle. East.	A. Face of Circle. West.	B. Face of Circle. East.	B. Face of Circle. West.	Mean Dip.	Monthly Mean for each Needle.	Monthly Mean.
	h. m.	h. m.			° ′	° ′	° ′	° ′	° ′		° ′
JAN. 3	14 32	15 54	N.	2	20 43·4	21 40·9	20 13·1	20 59·7	20 54·3		
„ 7	12 5	13 50	D.	2	20 38·3	21 44·9	20 19·9	21 0·6	20 55·9	No. 1	
„ 10	14 55	16 19	D.	1	20 51·0	21 42·1	20 16·6	20 46·4	20 54·0	20 54·5	
„ 14	12 19	13 43	N.	1	20 52·5	21 38·9	20 17·0	20 46·1	20 53·6		
„ 17	14 35	15 58	N.	2	20 46·5	21 38·0	20 15·0	20 58·1	20 54·4		20 54·1
„ 21	12 21	13 44	N.	2	20 43·5	21 31·2	20 12·5	21 0·0	20 51·8	No. 2	
„ 24	14 43	16 9	D.	1	20 48·2	21 36·0	20 24·5	20 50·7	20 54·8	20 53·8	
„ 28	12 25	13 50	V.G.G.	1	20 52·6	21 37·7	20 24·7	20 48·0	20 55·7		
„ 31	14 44	16 12	V.G.G.	2	20 47·7	21 29·0	20 13·0	21 0·7	20 52·6		
FEB. 4	11 53	13 15	D.	2	20 42·7	21 38·7	20 13·5	21 8·7	20 55·9		
„ 7	14 44	16 3	D.	1	20 50·1	21 41·4	20 30·2	20 40·0	20 55·4		
„ 10	12 10	13 39	N.	1	20 49·2	21 38·1	20 23·5	20 45·6	20 54·1	No. 1	
„ 14	14 48	16 12	N.	2	20 46·1	21 32·5	20 10·7	21 8·1	20 54·3	20 54·5	20 54·6
„ 18	12 6	13 40	D.	2	20 39·9	21 31·0	20 19·5	21 9·7	20 55·0		
„ 21	14 30	15 50	D.	1	20 46·4	21 34·9	20 26·6	20 49·7	20 54·4	No. 2	
„ 25	12 22	13 44	N.	1	20 53·4	21 38·5	20 20·0	20 44·0	20 54·0	20 54·8	
„ 27	14 36	15 59	N.	2	20 45·0	21 34·6	20 11·2	21 5·7	20 54·1		
MAR. 3	12 20	13 43	D.	2	20 48·7	21 34·5	20 20·2	20 56·7	20 55·0		
„ 6	15 1	16 31	D.	1	20 54·6	21 42·7	20 29·0	20 36·5	20 55·7		
„ 10	12 21	13 44	N.	1	20 53·2	21 39·2	20 25·1	20 48·2	20 56·4	No. 1	
„ 13	14 35	15 58	N.	2	20 42·1	21 34·5	20 13·1	21 1·9	20 52·9	20 55·8	20 55·3
„ 17	12 2	13 45	D.	2	20 37·0	21 33·6	20 23·0	21 3·0	20 54·1		
„ 20	15 10	16 37	D.	1	20 55·1	21 33·1	20 29·6	20 45·4	20 55·8		
„ 24	12 14	13 41	N.	1	20 52·2	21 36·5	20 22·7	20 49·5	20 55·2	No. 2	
„ 27	14 32	15 54	N.	2	20 47·7	21 39·2	20 9·9	21 9·0	20 56·4	20 55·0	
„ 31	12 19	13 44	D.	2	20 48·0	21 35·1	20 21·0	21 1·8	20 56·5		
APRIL 3	14 32	16 1	V.G.G.	1	20 56·9	21 35·6	20 33·0	20 41·0	20 56·6		
„ 7	12 20	13 45	N.	1	20 51·7	21 39·2	20 9·5	20 55·5	20 54·0		
„ 10	14 32	15 56	N.	2	20 49·2	21 38·9	20 13·9	21 4·1	20 56·5	No. 1	
„ 14	12 15	13 45	D.	2	20 59·9	21 31·5	20 23·7	20 53·2	20 57·1	20 54·4	20 55·5
„ 17	14 20	15 45	D.	1	20 49·7	21 31·1	20 22·0	20 56·9	20 54·9		
„ 21	13 0	14 21	N.	1	20 54·2	21 34·0	20 12·5	20 48·7	20 52·3		
„ 24	14 47	16 11	N.	2	20 49·0	21 29·6	20 16·2	21 2·7	20 54·4	No. 2	
„ 28	12 14	13 37	D.	2	20 53·0	21 21·2	20 39·2	21 0·1	20 58·4	20 56·6	

1896. Date.	Bombay Civil Time (0 to 24 hours). At commencement.	At conclusion.	Observer.	Needle marked.	End of Needle Dipping. A. Face of Circle. East.	A. Face of Circle. West.	B. Face of Circle. East.	B. Face of Circle. West.	Mean Dip.	Monthly Mean for each Needle.	Monthly Mean.
	h. m.	h. m.			° ′	° ′	° ′	° ′	° ′		° ′
MAY 1	14 19	15 42	D.	1	21 15·6	21 11·6	20 32·2	20 23·0	20 50·6		
„ 5	12 16	13 45	N.	1	21 18·5	21 9·4	20 42·1	20 19·7	20 52·4		
„ 8	14 23	15 49	N.	2	21 23·4	20 46·9	21 2·5	20 33·0	20 56·4	No. 1	
„ 12	12 11	13 39	D.	2	21 34·2	20 45·7	20 52·7	20 42·0	20 58·6	20 54·3	
„ 15	14 45	16 11	D.	1	21 28·2	21 7·0	20 41·2	20 22·9	20 54·8		20 56·7
„ 19	12 10	13 35	N.	1	21 42·9	21 2·1	20 59·7	20 4·5	20 57·3		
„ 22	14 27	15 52	N.	2	21 45·7	20 42·5	21 10·0	20 22·7	21 0·2	No. 2	
„ 26	11 50	13 19	D.	2	21 39·4	20 55·9	21 36·2	20 3·0	21 3·6	20 59·7	
„ 29	14 2	15 24	D.	1	21 56·0	20 46·8	20 50·3	20 11·8	20 56·2		
JUNE 2	12 17	13 38	N.	1	21 28·2	20 53·6	20 47·2	20 25·5	20 53·6		
„ 5	14 32	15 58	N.	2	22 13·1	20 17·1	21 29·1	20 4·5	21 0·9		
„ 9	12 22	13 46	D.	2	22 3·1	20 22·1	21 17·0	20 18·4	21 0·1	No. 1	
„ 12	15 0	16 30	D.	1	21 33·7	20 49·9	20 56·2	20 15·1	20 53·7	20 54·8	
„ 16	12 18	13 40	N.	1	21 30·7	20 56·6	21 5·5	20 11·5	20 56·1		20 57·3
„ 19	14 44	16 3	N.	2	21 30·0	20 50·9	21 7·1	20 28·4	20 59·1		
„ 23	12 7	13 39	D.	2	21 31·9	20 58·7	21 14·4	20 20·4	21 1·3	No. 2	
, 26	14 48	16 14	D.	1	21 27·1	20 59·1	21 13·5	20 8·3	20 57·0	21 0·3	
„ 30	12 8	13 35	N.	1	21 40·5	20 52·4	20 50·2	20 12·2	20 53·8		
JULY 3	14 33	15 52	N.	2	21 56·2	20 27·7	21 38·4	20 1·4	21 0·9		
„ 7	12 3	13 24	D.	2	21 45·7	20 38·4	21 28·5	20 6·9	20 59·9		
„ 10	14 51	16 15	D.	1	21 35·0	20 52·4	20 58·9	20 19·2	20 56·4	No. 1	
„ 14	12 6	13 36	N.	1	21 51·5	20 37·7	21 5·1	20 10·6	20 56·2	20 54·7	
„ 17	14 27	15 51	N.	2	21 57·1	20 30·6	21 22·1	20 5·5	20 58·8		20 57·2
„ 21	12 0	13 20	D.	2	21 48·1	20 33·9	21 20·9	20 16·7	20 59·9		
„ 24	14 33	16 0	V.G.G.	1	21 38·7	20 49·4	20 59·7	20 15·4	20 55·8	No. 2	
„ 28	12 10	13 40	N.	1	21 46·2	20 39·2	21 1·5	19 55·4	20 50·6	20 59·2	
„ 31	14 25	15 52	N.	2	21 39·5	20 47·6	21 3·2	20 14·9	20 56·3		
AUG. 4	12 9	13 34	D.	2	21 36·7	20 46·1	20 56·1	20 30·4	20 57·3		
„ 7	14 40	16 2	D.	1	21 40·6	20 46·2	20 59·9	20 3·2	20 52·5		
„ 11	12 6	13 32	N.	1	21 37·6	20 52·7	20 57·1	19 58·0	20 51·3	No. 1	
„ 14	14 27	15 49	N.	2	21 45·0	20 48·5	20 55·6	20 17·7	20 56·7	20 52·4	
„ 18	12 30	13 46	V.G.G.	2	21 45·2	20 51·7	20 54·5	20 11·0	20 55·6		20 54·3
„ 21	14 47	16 11	D.	1	21 32·3	20 47·6	20 59·6	20 10·1	20 52·4		
„ 25	12 7	13 35	N.	1	21 50·2	20 48·0	20 50·2	20 5·7	20 53·5	No. 2	
„ 28	14 52	16 15	N.	2	21 55·9	20 51·2	20 51·7	20 1·1	20 55·0	20 56·1	

1896. Date.	Bombay Civil Time (0 to 24 hours). At commencement.	At conclusion.	Observer.	Needle marked.	End of Needle Dipping. A. Face of Circle. East.	A. Face of Circle. West.	B. Face of Circle. East.	B. Face of Circle. West.	Mean Dip.	Monthly Mean for each Needle.	Monthly Mean.
	h. m.	h. m.			° ′	° ′	° ′	° ′	° ′		° ′
SEPT. 1	12 25	13 45	V.G.G.	2	21 50·6	20 47·9	20 57·7	20 2·4	20 54·6		
„ 4	15 3	16 22	D.	1	21 42·7	20 39·4	20 59·1	20 18·0	20 54·8		
„ 8	12 10	13 33	N.	1	21 41·1	20 52·2	20 53·9	20 24·2	20 57·8	No. 1	
„ 11	14 33	15 56	N.	2	21 57·2	20 42·2	20 43·5	20 13·5	20 54·1	20 55·5	20 56·3
„ 15	12 22	13 47	D.	2	21 49·0	20 52·7	20 38·3	20 25·7	20 56·4		
„ 18	14 45	16 4	D.	1	21 38·1	20 46·9	20 52·6	20 29·1	20 56·7		
„ 22	12 15	13 37	N.	1	21 34·0	20 52·4	20 55·6	20 9·5	20 52·9	No. 2	
„ 25	14 25	15 52	N.	2	21 34·5	21 5·6	20 45·7	20 35·2	21 0·2	20 56·9	
„ 29	12 7	13 35	D.	2	21 24·2	21 11·9	20 52·6	20 28·1	20 59·2		
OCT. 2	15 12	16 30	D.	1	21 35·7	20 53·7	20 52·9	20 19·5	20 55·4		
„ 6	12 13	13 37	N.	1	21 20·5	21 14·2	20 46·4	20 5·1	20 51·5		
„ 9	14 27	15 55	N.	2	21 32·4	20 51·1	21 0·1	20 20·1	20 55·9	No. 1	
„ 13	12 0	13 17	D.	2	21 24·7	21 1·6	20 59·4	20 23·9	20 57·4	20 53·3	
„ 16	15 0	16 20	D.	1	21 17·5	21 14·3	20 46·6	20 17·5	20 54·0		20 54·4
„ 20	12 10	13 30	N.	1	21 25·4	21 6·0	20 50·4	20 6·7	20 52·1		
„ 23	14 18	15 40	N.	2	21 24·6	20 55·7	20 57·4	20 20·9	20 54·6	No. 2	
„ 27	12 5	13 38	D.	2	21 19·6	20 59·0	21 1·9	20 21·7	20 55·5	20 55·8	
„ 30	14 20	15 46	V.G.G.	1	21 29·7	21 14·4	20 49·7	19 59·4	20 53·3		
NOV. 2	12 10	13 34	N.	1	21 32·7	21 9·6	20 38·0	20 20·5	20 55·2		
„ 6	14 17	15 42	N.	2	21 37·9	20 51·0	21 8·6	20 2·0	20 54·9	No. 1	
„ 10	12 25	13 43	V.G.G.	2	21 43·6	20 52·7	21 2·2	20 4·5	20 55·7	20 55·8	
„ 13	14 38	16 1	D.	1	21 23·9	21 10·7	20 44·1	20 26·7	20 56·3		20 56·1
„ 17	12 8	13 32	N.	1	21 29·2	21 15·7	21 3·0	19 53·4	20 55·3		
„ 20	14 20	15 43	N.	2	21 36·4	21 1·2	20 45·9	20 27·0	20 57·6	No 2	
„ 24	12 13	13 38	V.G.G.	2	21 39·0	21 1·2	20 48·7	20 21·7	20 57·6	20 56·4	
„ 27	14 45	16 5	D.	1	21 21·9	21 15·1	21 5·7	20 2·7	20 56·3		
DEC. 1	12 10	13 35	N.	1	21 36·2	21 6·2	20 45·2	19 56·5	20 51·0		
„ 4	14 20	15 41	N.	2	21 52·9	20 53·9	20 56·1	20 19·5	21 0·6		
„ 8	12 4	13 31	D.	2	21 54·5	20 42·4	21 3·0	20 7·5	20 56·8	No. 1	
„ 11	14 48	16 13	D.	1	21 40·1	20 56·0	21 0·1	19 52·7	20 52·2	20 53·4	
„ 15	12 8	13 32	N.	1	21 45·7	21 3·0	20 45·5	19 54·5	20 52·2		20 55·2
„ 18	14 20	15 49	N.	2	21 50·4	20 52·0	20 56·0	20 5·5	20 56·0		
„ 22	13 13	14 39	D.	2	21 51·0	20 50·7	20 55·6	20 9·7	20 56·7		
„ 25	14 20	15 43	N.	1	21 47·9	20 54·5	20 49·0	20 9·7	20 55·3	No. 2	
„ 29	12 26	13 42	V.G.G	1	21 48·6	20 52·2	20 52·1	20 12·0	20 56·2	20 57·5	

The Mean Dip for the year ... { With Needle No. 1 = 20 54·4 / With Needle No. 2 = 20 56·8

The Mean Dip for the year 1896 = 20 55·6

Absolute Magnetical Observations.—Table III *a*.

SUPPLEMENTARY OBSERVATIONS OF INCLINATION, 1896.

Taken with Barrow's Dip Circle, with Microscopes, No. 49 and three 3½-inch Needles, Nos. $\frac{1}{81}$ and $\frac{2}{81}$, by John Dover, and No. 5 by Adie.

1896. Date.	Bombay Civil Time (0 to 24 hours). At commencement.	At conclusion.	Observer.	Needle marked.	End of Needle Dipping. A. Face of Circle. East.	A. Face of Circle. West.	B. Face of Circle. East.	B. Face of Circle. West.	Mean Dip.	Monthly Mean for each Needle.	Monthly Mean.
	h. m.	h. m.			° ′	° ′	° ′	° ′	° ′		° ′
JAN. 3	13 40	16 46	N.	$\frac{2}{81}$	20 27·5	21 17·1	20 26·9	21 20·0	20 52·9		
,, 7	11 11	14 42	D.	$\frac{2}{81}$	20 29·1	21 13·6	20 31·6	21 23·4	20 54·4		
,, 10	14 6	17 9	D.	$\frac{1}{81}$	20 45·3	21 13·1	20 34·7	21 14·0	20 56·8	No. $\frac{1}{81}$	
,, 14	11 28	14 35	N.	$\frac{1}{81}$	20 46·2	21 9·5	20 28·7	21 19·5	20 56·0	20 55·9	
,, 17	13 41	16 47	N.	$\frac{2}{81}$	20 28·1	21 21·6	20 25·9	21 17·6	20 53·3		20 54·4
,, 21	11 29	14 37	N.	$\frac{2}{81}$	20 25·9	21 19·2	20 26·0	21 18·0	20 52·3		
,, 24	13 47	17 0	D.	$\frac{1}{81}$	20 40·6	21 11·6	20 30·9	21 18·1	20 55·3	No. $\frac{2}{81}$	
,, 28	11 28	14 42	V.G.G.	$\frac{1}{81}$	20 44·7	21 8·7	20 34·2	21 14·7	20 55·6	20 53·3	
,, 31	13 52	17 3	V.G.G.	$\frac{2}{81}$	20 30·6	21 15·5	20 30·0	21 17·7	20 53·4		
FEB. 4	11 3	14 10	D.	$\frac{2}{81}$	20 32·3	21 19·0	20 26·9	21 20·9	20 54·8		
,, 7	13 49	16 55	D.	$\frac{1}{81}$	20 46·7	21 11·1	20 33·1	21 19·7	20 57·6	No. $\frac{1}{81}$	
,, 10	11 19	14 35	N.	$\frac{1}{81}$	20 44·1	21 10·7	20 33·0	21 21·1	20 57·2	20 56·0	
,, 14	13 55	17 3	N.	$\frac{2}{81}$	20 28·4	21 17·7	20 33·4	21 19·2	20 54·7		20 55·4
,, 18	11 15	14 32	D.	$\frac{2}{81}$	20 32·6	21 16·4	20 36·0	21 16·1	20 55·3		
,, 21	13 31	16 52	D.	$\frac{1}{81}$	20 47·6	21 7·9	20 29·9	21 15·4	20 55·2	No. $\frac{2}{81}$	
,, 25	11 30	14 35	N.	$\frac{1}{81}$	20 46·4	21 8·7	20 25·7	21 16·2	20 54·2	20 54·7	
,, 27	13 43	16 50	N.	$\frac{2}{81}$	20 33·2	21 14·6	20 36·1	21 12·7	20 54·1		
MAR. 3	11 27	14 39	D.	$\frac{2}{81}$	20 37·6	21 22·2	20 30·2	21 14·1	20 56·0		
,, 6	14 11	17 27	D.	$\frac{1}{81}$	20 43·9	21 13·5	20 29·0	21 13·1	20 54·9		
,, 10	11 29	14 37	N.	$\frac{1}{81}$	20 42·1	21 16·9	20 40·0	21 6·4	20 56·3	No. $\frac{1}{81}$	
,, 13	13 44	16 50	N.	$\frac{2}{81}$	20 33·2	21 19·1	20 32·7	21 7·6	20 53·1	20 54·8	
,, 17	11 10	14 44	D.	$\frac{2}{81}$	20 29·0	21 16·5	20 31·7	21 10·7	20 52·0		20 53·6
,, 20	14 20	17 30	D.	$\frac{1}{81}$	20 38·0	21 19·9	20 32·1	21 6·5	20 54·1		
,, 24	11 20	14 35	N.	$\frac{1}{81}$	20 37·0	21 20·4	20 33·9	21 3·9	20 53·8	No. $\frac{2}{81}$	
,, 27	13 30	16 44	N.	$\frac{2}{81}$	20 32·0	21 16·2	20 29·7	21 3·7	20 50·4	20 52·7	
,, 31	11 20	14 38	D.	$\frac{2}{81}$	20 46·1	21 13·1	20 24·1	21 5·7	20 52·2		
APR. 3	13 35	16 52	V.G.G.	$\frac{1}{81}$	20 41·5	21 17·7	20 37·2	21 1·9	20 54·6		
,, 7	11 25	14 37	N.	$\frac{1}{81}$	20 41·7	21 17·0	20 21·7	21 13·0	20 53·3	No. $\frac{1}{81}$	
,, 10	13 40	16 48	N.	$\frac{2}{81}$	20 31·7	21 16·2	20 30·6	21 3·7	20 50·5	20 56·8	
,, 14	11 20	14 35	D.	$\frac{2}{81}$	20 33·8	21 8·1	20 40·4	20 50·2	20 48·1		20 53·2
,, 17	13 26	16 40	D.	$\frac{1}{81}$	20 36·4	21 15·9	20 27·5	21 16·2	20 54·0		
,, 21	12 11	15 21	N.	$\frac{1}{81}$	20 47·4	21 19·9	20 35·6	21 38·1	21 5·2	No. $\frac{2}{81}$	
,, 24	13 32	17 0	N.	$\frac{2}{81}$	20 23·7	21 9·9	20 36·9	21 1·9	20 48·1	20 49·6	
,, 28	11 22	14 45	D.	$\frac{2}{81}$	20 38·2	21 11·7	20 36·2	21 1·7	20 51·9		

1896. Date.	Bombay Civil Time (0 to 24 hours). At commencement. h	m.	At conclusion. h.	m.	Observer.	Needle marked.	End of Needle Dipping. A. Face of Circle. East. °	′	West. °	′	B. Face of Circle. East. °	′	West. °	′	Mean Dip. °	′	Monthly Mean for each Needle.	Monthly Mean. °	′
MAY 1	13	25	16	35	D.	1/81	20	41·2	20	54·9	20	49·0	21	6·4	20	52·9			
„ 5	11	23	14	40	N.	1/81	20	51·5	20	54·6	21	5·0	20	45·6	20	54·2	No. 1/81		
„ 8	13	30	16	41	N.	2/81	21	19·1	20	8·2	21	5·5	20	49·5	20	50·6	20 °	54·6 ′	
„ 12	11	16	14	34	D.	2/81	21	20·1	20	7·9	21	13·4	20	57·5	20	54·7			
„ 15	13	50	17	5	D.	1/81	20	58·7	20	48·4	21	7·6	20	48·1	20	55·7		20	55·4
„ 19	11	20	16	39	N.	1/81	20	57·6	20	41·9	21	10·6	20	50·7	20	55·2			
„ 22	13	35	16	46	N.	2/81	21	16·4	20	9·5	21	41·2	20	47·2	20	58·6	No. 2/81		
„ 26	10	58	14	15	D.	2/81	21	18·4	20	22·7	21	33·4	20	53·4	21	2·0	20 °	56·5 ′	
„ 29	13	9	16	18	D.	1/81	21	7·9	20	40·2	21	8·7	20	43·4	20	55·0			
JUNE 2	11	25	14	33	N.	1/81	21	10·2	20	40·7	21	16·2	20	27·7	20	53·7			
„ 5	13	40	16	50	N.	2/81	21	18·1	20	23·7	21	16·0	20	51·7	20	57·4			
„ 9	11	30	14	35	D.	2/81	21	17·9	20	31·6	21	7·1	20	41·9	20	54·6	No. 1/81		
„ 12	14	4	17	22	D.	1/81	21	23·1	20	36·7	21	11·1	20	28·0	20	54·7	20 °	54·2 ′	
„ 16	11	28	14	34	N.	1/81	21	18·9	20	47·9	21	17·4	20	17·7	20	55·5		20	54·7
„ 19	13	38	16	52	N.	2/81	21	20·5	20	20·1	21	35·5	20	17·9	20	53·5			
„ 23	11	12	14	35	D.	2/81	21	28·7	20	28·6	21	24·4	20	23·2	20	56·2	No. 2/81		
„ 26	13	55	17	10	D.	1/81	21	14·9	20	57·5	21	6·3	20	15·5	20	53·5	20 °	55·4 ′	
„ 30	11	15	14	30	N.	1/81	21	5·2	21	4·8	21	7·6	20	16·7	20	53·6			
JULY 3	13	40	16	45	N.	2/81	21	26·9	20	11·7	21	28·1	20	25·0	20	52·9			
„ 7	11	10	14	17	D.	2/81	21	25·0	20	23·0	21	17·6	20	30·7	20	54·1	No. 1/81		
„ 10	14	0	17	10	D.	1/81	21	7·7	21	12·6	21	2·4	20	19·3	20	55·5	20 °	55·1 ′	
„ 14	11	12	14	32	N.	1/81	21	24·7	21	2·9	20	46·2	20	34·7	20	57·1			
„ 17	13	32	16	47	N.	2/81	21	29·1	20	9·7	21	30·5	20	17·7	20	51·7		20	53·7
„ 21	11	7	14	12	D.	2/81	21	27·3	20	16·5	21	34·9	20	11·1	20	52·4			
„ 24	13	40	16	54	V.G.G.	1/81	21	23·0	21	4·2	20	48·9	20	27·2	20	55·8	No. 2/81		
„ 28	11	15	14	35	N.	1/81	21	12·6	20	45·4	21	1·6	20	29·0	20	52·1	20 °	52·6 ′	
„ 31	13	30	16	45	N.	2/81	21	13·0	20	26·6	21	16·1	20	31·1	20	51·7			
AUG. 4	11	20	14	35	D.	2/81	21	7·7	20	28·5	21	15·4	20	33·9	20	51·4			
„ 7	13	48	16	55	D.	1/81	21	7·5	20	50·3	20	54·0	20	35·9	20	51·9	No. 1/81		
„ 11	11	13	14	27	N.	1/81	21	9·9	20	59·2	20	47·1	20	27·4	20	50·9	20 °	52·3 ′	
„ 14	13	35	16	43	N.	2/81	21	16·1	20	22·9	21	16·4	20	25·1	20	50·1		20	51·2
„ 18	11	35	14	35	V.G.G.	2/81	21	11·5	20	26·0	21	21·5	20	22·7	20	50·4	No. 2/81		
„ 21	13	55	17	0	D.	1/81	21	2·9	20	56·9	20	51·7	20	34·1	20	51·4	20 °	50·2 ′	
„ 25	11	15	14	29	N.	1/81	21	12·1	20	58·9	20	54·6	20	33·9	20	54·9			
„ 28	14	0	17	6	N.	2/81	20	59·5	20	35·0	21	4·4	20	36·4	20	48·8			

1896. Date.	Bombay Civil Time (0 to 24 hours). At commencement.	At conclusion.	Observer.	Needle marked.	End of Needle Dipping. A. Face of Circle. East.	A. Face of Circle. West.	B. Face of Circle. East.	B. Face of Circle. West.	Mean Dip.	Monthly Mean for each Needle.	Monthly Mean.
	h. m.	h. m.			° ′	° ′	° ′	° ′	° ′		° ′
SEPT. 1	11 30	14 35	V.G.G.	2/81	21 0·2	20 34·6	21 2·7	20 34·5	20 48·0		
„ 4	14 9	17 15	D.	1/81	21 5·7	20 57·7	20 57·4	20 26·0	20 51·7	No. 1/81	
„ 8	11 17	14 22	N.	1/81	20 53·0	20 46·9	21 4·9	20 50·2	20 53·7	20 52·5	
„ 11	13 43	16 46	N.	2/81	21 3·6	20 40·5	21 1·1	20 32·1	20 49·3		
„ 15	11 25	14 43	D.	2/81	21 12·6	20 32·5	21 10·7	20 31·0	20 51·7		20 51·7
„ 18	13 55	16 58	D.	1/81	20 48·4	20 43·7	21 6·8	20 57·6	20 54·1		
„ 22	11 20	14 33	N.	1/81	20 57·2	20 58·9	20 54·6	20 31·4	20 50·5	No. 2/81	
„ 25	13 34	16 45	N.	2/81	20 57·6	20 43·9	20 59·6	20 50·0	20 52·8	20 51·0	
„ 29	11 15	14 26	D.	2/81	20 54·1	20 41·0	21 4·6	20 52·9	20 53·1		
OCT. 2	14 24	17 29	D.	1/81	20 50·4	20 58·1	21 2·1	20 33·0	20 50·9		
„ 6	11 23	14 35	N.	1/81	21 0·0	20 55·6	20 40·5	20 46·1	20 50·5	No. 1/81	
„ 9	13 35	16 49	N.	2/81	20 59·2	20 42·2	21 9·8	20 31·7	20 50·7	20 52·0	
„ 13	11 9	14 12	D.	2/81	20 55·5	20 48·2	21 3·8	20 42·2	20 52·4		
„ 16	14 10	17 15	D.	1/81	21 6·7	20 53·0	20 37·3	20 49·9	20 51·7		20 51·4
„ 20	11 20	14 23	N.	1/81	21 15·5	20 51·2	20 44·1	20 43·2	20 53·5		
„ 23	13 28	16 38	N.	2/81	20 58·0	20 37·7	20 53·7	20 47·6	20 49·2	No. 2/81	
„ 27	11 15	14 29	D.	2/81	20 57·3	20 38·9	20 52·7	20 54·5	20 50·8	20 50·8	
„ 30	13 20	16 42	V.G.G.	1/81	21 13·7	20 53·0	20 45·0	20 41·5	20 53·3		
NOV. 2	11 17	14 31	N.	1/81	21 8·4	20 56·4	20 53·0	20 34·5	20 53·1		
„ 6	13 27	16 38	N.	2/81	20 58·9	20 40·4	21 2·2	20 35·7	20 49·3	No. 1/81	
„ 10	11 30	14 35	V.G.G.	2/81	20 59·7	20 35·6	21 6·6	20 35·5	20 49·3	20 52·4	
„ 13	13 47	16 52	D.	1/81	21 12·2	20 52·7	20 53·0	20 37·1	20 53·7		
„ 17	11 15	14 29	N.	1/81	21 5·5	20 51·5	21 2·7	20 24·1	20 50·9		20 50·9
„ 20	13 25	16 34	N.	2/81	21 4·0	20 28·0	21 13·4	20 32·2	20 49·4	No. 2/81	
„ 24	11 26	14 35	V.G.G.	2/81	21 6·0	20 33·2	21 6·4	20 33·0	20 49·6	20 49·4	
„ 27	13 55	16 57	D.	1/81	21 3·1	20 45·4	21 9·4	20 30·5	20 52·1		
DEC. 1	11 20	14 27	N.	1/81	21 8·2	20 58·2	20 45·5	20 41·2	20 53·3		
„ 4	13 27	16 43	N.	2/81	20 58·6	20 42·2	21 7·2	20 32·2	20 50·0	No. 1/81	
„ 8	11 10	14 22	D.	2/81	21 13·0	20 26·7	21 3·9	20 31·4	20 48·7	20 53·2	
„ 11	13 58	17 11	D.	1/81	21 17·2	20 46·7	20 58·7	20 30·4	20 53·2		
„ 15	16 11	17 30	N.	*5	23 53·1	23 2·7	19 5·7	17 27·6	20 52·3	No. 2/81	20 52·2
„ 18	13 25	16 45	N.	2/81	21 11·7	20 30·1	21 8·9	20 28·7	20 49·8	20 50·1	
„ 22	12 22	15 30	D.	2/81	21 9·5	20 31·2	21 14·4	20 32·4	20 51·9		
„ 25	13 29	16 39	N.	5	21 45·1	20 59·0	20 50·9	20 12·2	20 56·8	No. 5,	
„ 29	11 40	14 30	V.G.G.	5	21 37·7	20 48·9	20 53·5	20 16·4	20 54·1	20 54·4	

The Mean Dip for the year... { With Needle No. 1/81 †= 20 54·2 ; With Needle No. 2/81 = 20 52·2 }

The Mean Dip for the year 1896 = 20 53·2

* Needle No. 5 by Adie was substituted for needle No. 1/81, as one of the axles of the latter was broken while cleaning.

† The Mean Dip for the year by needle No. 1/81 is the average of 49 observations only instead of 52 as usual.

APPENDIX.

Part A.—A short note on the disturbance of the Magnetical and Meteorological Instruments at the Colába Observatory during the earthquake of 12th June 1897.

Part B.—Magnetical Observations, Declination, 1894, 1895, 1896.

Part C.—Dines' Pressure Tube Anemometer.

Part D.—Adjustment of Grubb's Declinometer.

Part E.—Fifty years of Grubb's Declinometer and the Declination at Bombay.

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APPENDIX A.

A SHORT NOTE ON THE DISTURBANCE OF THE MAGNETICAL AND METEOROLOGICAL INSTRUMENTS AT THE COLABA OBSERVATORY DURING THE EARTHQUAKE OF 12TH JUNE 1897.

1. The four instruments the traces of which are examined, are the Declination, Horizontal Force and Vertical Force Magnetographs and the Barograph. The instruments not being seismological, the following discussion of the character of the disturbance based upon the traces of these instruments must obviously be regarded as an attempt at explanation and as an attempt only.

2. Colába, it appears, was situated well outside the area of perceptible shaking, and the distance of the Observatory from the centre of disturbance, was sufficiently large to render the disturbance as it reached Colába very feeble; and yet it was just sufficiently strong to leave some record of its peculiar characteristics. All traces have been enlarged* about $2\frac{1}{2}$ times, but the exact time and measurements have been derived from the original photograms.

3. It must be noted here, that the disturbance fortunately occurred just after 16 hours —the time of hourly *eye observations*; a valuable opportunity, therefore, was secured, and it became possible to note and study the peculiar behaviour of the instruments during their disturbances some of which by the rapidity of their movements could not have been photographed. There may be some doubt as to whether the disturbance in the Magnetographs was due to mechanical or magnetic action, but no such doubt can exist for the Barograph. The disturbance of this instrument must have been caused by distortional waves or due to tilting of the instrument. That the movement was due to mechanical action and not to pressure changes in the atmosphere may be presumed from the fact that all magnetic instruments distinctly showed mechanical disturbance and that a careful examination of Dines' Pressure Tube Anemometer chart did not show any trace of atmospheric disturbance. It will be noticed that the maximum effect of the disturbance as photographed in the Barograph trace followed the largest wave shown by Declination and Vertical Force Magnetographs later by about 1^m.

4. With regard to the disturbed trace of the Declination Magnetograph on the other hand, it is difficult to conceive how condensation or distortional waves could affect the suspended magnet under an exhausted receiver, so as to set up large vibrations in it, simulating magnetic action. The magnet was disturbed mechanically, no doubt, by the seismic waves, and these disturbances were typical of *mechanical* action. The three motions (besides the vibratory motion) observed in the Declinometer at the time of disturbance showed (1) motion of the whole magnet parallel to itself (east and west), (2) motion of the magnet as a whole north and south, and (3) the slight bobbing motion of the ends of the magnet up and down. But neither of these motions would show increase of the scale reading, nor would vibratory motion, if set up by mechanical causes, continue for some time to show increase or decrease of declination. It may be noted that the intensity of the mechanical disturbance was feeble and the motion *observed* at the time of the disturbance showed no evidence of any great, much less violent, movements. Finally the peculiar character of the trace of this instrument, as will be seen later on, leaves no reasonable doubt that the disturbance was due to magnetic action which must have accompanied the seismic disturbance possibly as effect of a cause.

5. The case of the Horizontal Force Magnetograph is, however, different. From the peculiar nature of the bifilar suspension it becomes obvious that the tension of the wires being a principal factor in the general formula for the condition of equilibrium, it must be affected by any sudden displacement of the points of suspension. A distortional wave, for instance, suddenly lifting the points of suspension would result in increasing the tension, and any sudden depression would for a moment reduce the tension. A lateral movement also is likely to temporarily alter the conditions of equilibrium, and this magnetograph, therefore, appears to have been disturbed by the combined action of both the mechanical and magnetical disturbances, in this instance more perhaps by the latter than by the former, which was feeble as stated above. The trace shows some evidence of being affected by two causes superimposed upon each other, specially at the end of the disturb-

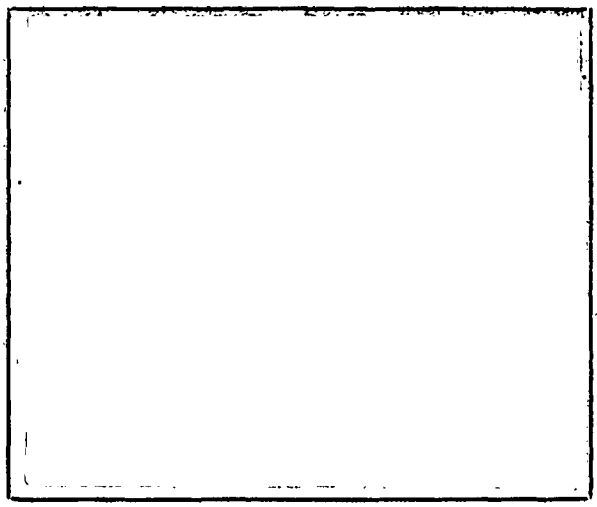
* The enlargements were kindly made by Raja Din Dayal & Co., Bombay, when other firms in Bombay failed to give satisfaction.

ance, where the blurred trace, probably due to change in the focal distance caused by a slight displacement of the mirror, appears suddenly to pass from a faint to a somewhat deep impression, bounded by *convex* curves.

6. Movement in the Vertical Force Magnetograph now remains to be inquired into. That the centre of gravity and point of support of the magnet in this instrument do not coincide and may cause rotation and therefore movement of the magnet, is self-evident; but from the conditions of the magnet and the quantity of motion observed it does not seem probable that the motion was due to mechanical causes. This instrument is under an exhausted receiver, but its knife edge is somewhat faulty and this magnetograph is, therefore, peculiarly sensitive to shocks—an accidental fall of a lamp-chimney on the floor of the room, heavy tread of visitors, and even a light knock of the hand results in *dislocation* of the curve. And such dislocations being frequent, special care is always taken to guard the instruments from such accidents. And yet no dislocation of the curve is noticed during the earthquake, which more or less strengthens the presumption that the movements of the earth must have been very feeble. But the instrument does show vibrations which naturally leads to the inference that they must have been caused by some magnetic action, the first vibration of which is timed to have taken place exactly when the declination trace is just lost by the 2nd wave.

7. And it would thus appear as if the seismic convulsion was in some way the cause of the magnetic action, the latter phenomenon running parallel to the former, increasing as it increased and subsiding as it subsided, every seismic wave having its companion effect in a magnetic wave.

8. With regard to direction, since the barograph would not show any indication of direction, nor the magnetographs all of which appear more or less to have been disturbed by magnetic action, it is difficult to come to any definite conclusions. Except perhaps in the case of declination the suggestive explanation given later on, if true, would point at least that the direction of the magnetic waves and therefore of seismic waves was inclined more to "east to west" than to "north to south." From the mechanical disturbance in the two instruments of Declination and Horizontal Force, the magnets of which are suspended at right angles to each other, the more pronounced motion *observed during the disturbance* in both, was from east to west. The focal distance of the latter instrument also appears to be slightly affected—due to motion of the mirror east to west. It, therefore, strengthens the presumption that the direction of oscillation of the earth particles at least must have had a strong easterly component; and the comparative feeble motion of both the magnets parallel to north and south direction, shows that the northerly component was present, but was feeble. We shall now examine each trace separately.



DECLINATION MAGNETOGRAPH.

9. The photograph shown here is a copy (enlarged about 2½ times) of the trace obtained from the Declination Magnetograph at the Colába Observatory. The time of vibration of the magnet is 5·33 seconds, and the original trace allows of an accuracy up to one minute in the determination of time. The scale value of the instrument is 28′·72 for an inch of tabulation in the original curve. The curve shows a part of the trace of the 12th June. The regular break seen on the trace is due to a metallic fan which automatically cuts off light every two hours for four minutes and a quarter. The middle of this break therefore represents 16^h on the 12th June. The usual sensitiveness of the photographic paper used at this Observatory has been ascertained by experiments with a steady light and found that an exposure of about 4^s to the usual kerosine burners (of about 4 candle-power) used, is enough for action; and with regard to impression of light during the vibration of the magnet it is found that oscillations of an amplitude of 3½ divisions of the scale equal to a displacement of about 28 minutes of declination and upwards are not recorded, the velocity of the speck of light together with the motion of the paper a little over half an inch in one hour precludes photographic action unless the amplitudes are brought within the above limit; and naturally the first impressions produced are at the extreme ends of the amplitude where the velocity is a minimum. It is only when the vibrations fall to within about 1½ divisions of scale that the paper shows the impression of light in the middle of the curve—that is, where the velocity is a maximum.

10. It is assumed in what follows that every seismic wave was accompanied by a temporary disturbance of the magnetic circulation. The first wave which appears to have just commenced the disturbance *in the instrument* must have passed Colába at about 5^m past sixteen. The seismic disturbance then seems to have grown in intensity and about 7^m past the hour the increased amplitudes (which by the way, it must be noted, were first performed about a higher zero showing a decreased easterly declination movement of the curve in the downward direction showing an increase) passed the limit above referred to and the trace is entirely lost. Immediately after this, however, the impulsive force appears to have ceased, and the damper of the magnetograph reducing the amplitudes (the logarithmic decrement has been ascertained to be = ·035) brings them within the limit of photographic action and the trace is just photographed at about 9^m past sixteen. This marks the time of temporary lull, for immediately afterwards the trace is lost, to appear faintly again but more strongly than before at about 11^m past the hour. This goes on, but the magnetic action now becomes less and less intense (presumably therefore the cause of the disturbance the seismic waves also) and the amplitudes of the vibrations falling within the limit of photographic action the record runs beautifully clear after this, and every wave is registered following its predecessor with more or less rhythmic precision, the intensity of the disturbance getting less and less till at about 34^m past the hour the disturbed trace runs into normal curve once more.

11. However one singular feature in the trace which is clearly visible in the latter part of the disturbed curve must also be explained, *viz.* the running of the vibration lines into each other by a *zig-zag* kind of trace. The most plausible explanation appears to be the following.

12. Assuming the normal curve to be the zero for the time, ordinary vibrations caused by a momentary disturbance would take place above and below this zero with *equal amplitudes.* But from the nature of the appearance of the zig-zag curve it seems as if the advancing seismic wave of condensation caused a decrement in the declination which lasted some time and compelled vibrations about a displaced zero *higher* up the curve; while during the receding wave (as it passed away) the reverse and opposite effect followed, the declination increasing, the vibrations were caused about a lowered zero, each phenomenon of course having its maximum and minimum effect. Fourteen such waves in all can be detected on the trace, the 2nd or 3rd of which, more possibly the 2nd, was the most intense, and each complete wave was followed by another after an average interval of about 2^m. The maximum effect of the advancing and the retreating parts of the wave being recorded at the average interval of about 1^m.

Disturbances in Declination Magnetograph.

Wave.	Maximum effect showing decreased declination.	Maximum effect showing increased declination.	
			Commencement of disturbance.
	h. m.	h. m.	h. m.
			16 5
1st	16 6	16 7	
2nd	„ 8·5	„ 9·5	
3rd	„ 10·5	„ 11·5	
4th	„ 12·5	„ 13·5	
5th	„ 15	„ 16	
6th	„ 17	„ 18	
7th	„ 19·5	„ 20·5	
8th	„ 21·5	„ 22·5	
9th	„ 24	„ 25	
10th	„ 26	„ 27	
11th	„ 28	„ 29	
12th	„ 30	„ 31	
13th	„ 31·5	„ 32·5	
14th	„ 33·5		
			End of disturbance.
			h. m.
			16 34

13. It will be seen that the beginning of the seismic disturbance as recorded by this instrument shows that it was somewhat sudden and abrupt, and the rise to the maximum after the commencement was within 3^m to 4^m, while the falling off as shown by the clear trace appears to have taken place gradually and steadily till normal conditions were reached. From the very regular character of the trace it appears that the time of vibration of the magnet must bear a certain relation to the period of disturbance, the exact time of vibration being some even multiple or sub multiple of the period; otherwise the regularity of the vibrations would be disturbed by "*interference.*"

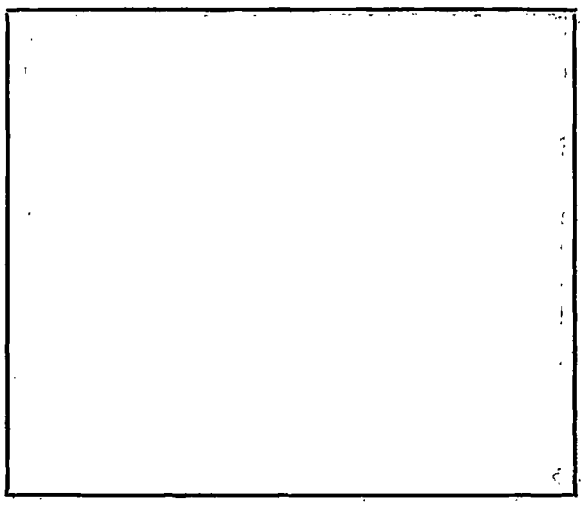
14. The *average* displacement of the declination East or West during the 4th wave, which is well defined, would equal that due to a change of ·00034 C.G.S. units in terms of force.

15. If by producing the curves on each side we get the *probable* amplitude of the most intense wave, where the two curves meet, the *average* displacement appears to be ·16 inch equal to ·00051 C.G S. in terms of force; and this shows that the 2nd wave was the most intense.

16. The magnetic disturbance of the kind registered on the trace appears suggestive of some kind of fluid action or some kind of undulatory action. The phenomenon appears as if due to an agitation of a fluid endowed with magnetic properties in some large subterranean cavity, upon which the indications * of the Colába magnets at least partly de-

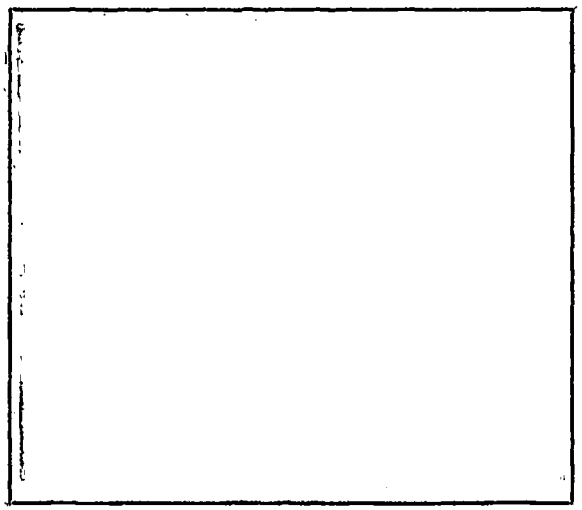
Regional and * Local magnetic effect.

pended, and as if the seismic convulsions produced waves in this fluid which approaching the instruments at Colába and passing away from them caused the alternate fall and rise of declination, these waves following each other regularly at an interval of 2^m. And any such wave it is obvious must travel East to West at right angles to the declination magnet to affect it with maximum effect—passage of such waves due North to South having no influence on the declination whatever.



HORIZONTAL FORCE MAGNETOGRAPH.

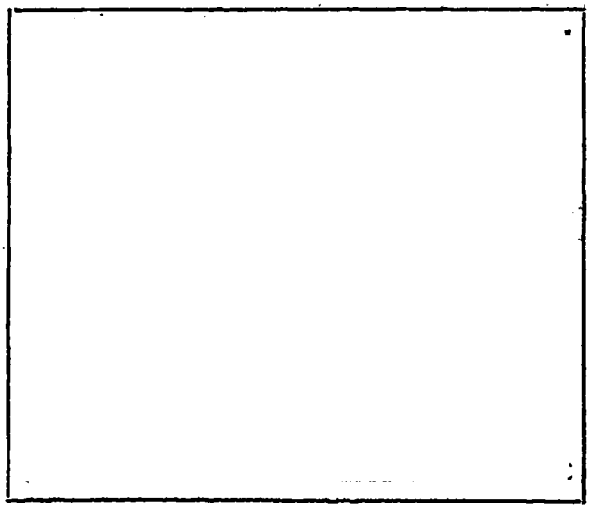
17. The trace here shows the disturbance in the horizontal intensity, which appears to have commenced early—about $2\frac{1}{2}^m$ after sixteen, while the instrument shows that the disturbance did not end before 36^m past sixteen; this must be due to the extreme sensitiveness of the instrument. The sudden displacement of the curve at the beginning shows that the vibrations must have been performed about a displaced zero above the curve, showing increased intensity equal to about ·00004 C.G.S. units, and the action presumably appears therefore more magnetic than mechanical, though both actions seem to be superimposed upon each other. At $5\frac{1}{2}^m$ past sixteen the vibrations pass the limit of photographic action and this perhaps marks the time of commencement of the more intense oscillations. The trace appears faintly at about $19\frac{1}{2}^m$ past the hour, less faintly at the extreme ends of the amplitudes than at the middle of the curve, and it continues faint till about 26^m past the hour when the trace suddenly darkens, but continues disturbed till 36^m past sixteen when the normal curve is resumed. The time of vibration of the magnet has been ascertained to be 8 seconds, and obviously, as this factor together with the period of disturbance must influence the motion of the magnet, the irregularity in the trace is perhaps to a considerable extent due to that cause. The scale value of the original trace is 28·67 for an inch of tabulation, and the clear length of suspension of the magnet is about 12 inches.



VERTICAL FORCE MAGNETOGRAPH.

18. The trace shown here is that of the Vertical Force Magnetograph. As pointed out elsewhere, this instrument is very sensitive to shocks resulting in dislocations of the curve. No such dislocation is detected during the earthquake. The unusual thickness of the vibration trace shows that the cause of the disturbance could not have been instantaneous, but must have acted for some considerable time; for vibrations of the above amplitude, if caused by, say, the momentary action of a deflector, would die out within half a minute, while the movements shown in the trace lasted each for over three minutes. The first wave appears to have commenced the disturbance at $6\frac{1}{2}^m$, attained the maximum at about 8^m and ended at about 10^m past sixteen. The second commenced immediately after this, reached its maximum effect at about 12^m and ended at 14^m past the hour.

19. The Observatory has two Vertical Force Magnetographs, both of which show the two waves clearly. The maximum effect of the first disturbance coincides in time with the greatest disturbance in the Declination Magnetograph. The amplitudes of the vibrations above the curve are somewhat smaller than those below the curve (this is more clearly shown in Vertical Force No. 2) which shows a slight decrease in Vertical Force during the time of disturbance. It may be noted that the time of vibration of this magnet is 5·35 seconds, slightly different from that of Declination Magnet. The scale value for an inch of tabulation for the original trace equals 28′·75.



BAROGRAPH.

20. The above trace shows the disturbance in the Barograph curve, which appears to have commenced at about $5\frac{1}{2}^m$ after sixteen, attained its maximum effect at about $9\frac{1}{2}^m$ and ended at about $12\frac{1}{2}^m$ past the hour. The oscillations in the column of mercury must have been caused by more than one distortional wave. The cumulative effect of timely forces but of very small dimensions may result in very large movements; and not knowing the exact conditions existing at the time of disturbance, it is very difficult even by experimental trials on a similar barometer, to form any idea as to the magnitude of the disturbing force. It is interesting to note how the disturbance, which commenced in this instrument about half a minute behind that of the Declination Magnetograph, reached its maximum effect fully one minute after the maximum effect is recorded in Declination Magnetograph. The oscillations of the column as photographed would correspond to a fall of mercury to about ·07 inch.

21. *Summary.*—Disturbance of Magnetical and Meteorological Instruments at Government Observatory, Colába, Bombay, during the earthquake of 12th June 1897—

		h. m.
DECLINATION, 1st shock ...	Commencement	... 16 5
	End ...	... 16 7
Most intense, 2nd shock—Maximum effect ...		... 16 8·5
End of disturbance...		... 16 34
HORIZONTAL FORCE, 1st shock.	Commencement	... 16 2·5
	End ...	... 16 5·5
End of disturbance		... 16 36
VERTICAL FORCE, 1st shock ...	Commencement	... 16 6·5
	End ...	... 16 10
Do. 2nd shock...	Commencement	... 16 10
	End ...	... 16 14
BAROGRAPH, 1st shock ..	Commencement	... 16 5·5
	Maximum effect	... 16 9·5
	End ...	... 16 12·5

APPENDIX B.

MAGNETICAL OBSERVATIONS.

DECLINATION.

1894—1895—1896.

While continuing the usual process adopted in this Observatory for obtaining the diurnal variation, tables IV to IX give the results of the magnetograph curves standardised by absolute observations, on lines suggested by the Committee of the British Association. The selected quiet days suitable for the determination of diurnal variation are the same as those selected for the year by the Astronomer Royal. Tables I, II and III give the disturbance days of the several years in detail. The results of Horizontal Force and Vertical Force will follow in the next volume.

TABLE I.—*Dates of Magnetic Disturbances, 1894.*

1894. Date.	MONTH. January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1	C.	S.	M.	S.	S.	M.	M.	C.	S.	S.	S.	S.
2	S.	M.	M.	S.	S.	S.	M.	S.	S.	M.	S.	S.
3	G.	M.	S.	S.	S.	S.	S.	S.	C.	S.	S.	S.
4	V.G.	S.	S.	C.	M.	S.	S.	S.	S.	M.	S.	C.
5	M.	S.	C.	S.	S.	S.	S.	S.	S.	M.	S.	M.
6	M.	S.	S.	M.	S.	S.	S.	S.	S.	S.	S.	M.
7	S.	S.	C.	M.	M.	S.	S.	S.	S.	S.	S.	S.
8	C.	C.	S.	S.	S.	S.	S.	S.	S.	S.	M.	M.
9	S.	C.	S.	S.	S.	G.	M.	S.	S.	S.	S.	S.
10	S.	C.	S.	S.	S.	G.	S.	S.	M.	C.	S.	S.
11	M.	S.	S.	C.	S.	M.	C.	S.	S.	S.	S.	S.
12	M.	M.	C.	M.	S.	S.	S.	S.	M.	C.	S.	S.
13	M.	S.	C.	M.	M.	S.	S.	M.	S.	S.	G.	M.
14	S.	S.	S.	S.	M.	S.	S.	S.	V.G.	S.	M.	S.
15	C.	S.	S.	C.	S.	S.	M.	M.	S.	S.	S.	M.
16	C.	S.	S.	C.	S.	S.	S.	S.	S.	M.	M.	S.
17	C.	S.	S.	G.	S.	S.	M.	C.	S.	S.	M.	S.
18	C.	S.	S.	S.	S.	S.	M.	S.	M.	M.	G.	S.
19	S.	M.	S.	M.	S.	M.	M.	G.	M.	S.	M.	S.
20	C.	M.	S.	S.	S.	M.	V.G.	V.G.	M.	S.	S.	S.
21	S.	G.	M.	S.	S.	M.	M.	M.	M.	S.	C.	S.
22	S.	G.	M.	C.	S.	S.	M.	S.	M.	S.	S.	S.
23	S.	V.G.	M.	C.	S.	S.	S.	S.	M.	C.	M.	S.
24	S.	M.	S.	S.	S.	S.	S.	M.	S.	S.	M.	S.
25	M.	V.G.	S.	S.	C.	S.	S.	S.	M.	M.	M.	C.
26	M.	M.	S.	S.	C.	S.	S.	M.	S.	S.	S.	S.
27	S.	M.	C.	S.	S.	S.	S.	S.	S.	M.	S.	S.
28	S.	V.G.	C.	S.	M.	S.	M.	S.	M.	S.	S.	S.
29	S.		S.	M.	S.	S.	S.	S.	S.	S.	S.	S.
30	S.		V.G.	M.	S.	S.	S.	S.	M.	M.	S.	S.
31	S.		M.		S.		S.	S.		M.		S.
Totals ... C.	7	3	6	6	2	0	1	2	1	3	1	2
S.	15	12	18	16	24	23	19	22	17	19	19	24
M.	7	8	6	7	5	5	10	5	11	9	8	5
G.	1	2	0	1	0	2	0	1	0	0	2	0
V.G.	1	3	1	0	0	0	1	1	1	0	0	0

Disturbances determined from Horizontal Force traces.

C.=calm; S.=small; M.=moderate; G.=great; V.G.=very great.

Days reckoned from 10 A.M. to 10 A.M. of the following day.

TABLE II.—*Dates of Magnetic Disturbances, 1895.*

1895. Date.	MONTH. January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1	M.	S.	S.	M.	S.	S.	M.	S.	C.	M.	S.	C.
2	S.	S.	S.	S.	S.	M.	S.	C.	C.	C.	S.	C.
3	S.	S.	M.	S.	S.	M.	C.	C.	S.	C.	S.	C.
4	S.	S.	S.	S.	C.	M.	S.	C.	M.	S.	S.	C.
5	S.	S.	S.	S.	S.	S.	S.	S.	M.	S.	S.	C.
6	M.	M.	S.	S.	S.	S.	S.	S.	C.	C.	C.	C.
7	S.	M.	S.	S.	S.	C.	C.	C.	C.	S.	C.	G.
8	S.	M.	M.	S.	S.	S.	S.	C.	C.	S.	M.	M.
9	M.	G.	M.	S.	S.	S.	S.	S.	C.	S.	G.	S.
10	S.	M.	S.	S.	G.	S.	C.	M.	C.	C.	G.	S.
11	M.	S.	S.	G.	S.	S.	S.	S.	C.	S.	M.	S.
12	S.	S.	S.	M.	S.	C.	M.	C.	C.	M.	M.	S.
13	S.	S.	G.	M.	C.	C.	S.	S.	C.	M.	S.	S.
14	C.	M.	G.	S.	S.	C.	S.	S.	S.	S.	C.	S.
15	S.	G.	S.	S.	S.	S.	S.	C.	M.	M.	S.	S.
16	S.	M.	M.	M.	S.	S.	S.	C.	S.	M.	S.	C.
17	M.	M.	M.	S.	S.	S.	S.	S.	S.	M.	S.	C.
18	M.	S.	M.	S.	S.	S.	C.	S.	S.	C.	C.	S.
19	M.	S.	S.	S.	C.	S.	S.	C.	S.	S.	C.	C.
20	M.	M.	S.	S.	S.	S.	S.	S.	M.	S.	C.	C.
21	S.	S.	S.	C.	C.	S.	C.	C.	C.	C.	C.	M.
22	S.	C.	M.	C.	S.	S.	C.	C.	S.	S.	C.	S.
23	S.	S.	S.	M.	S.	S.	S.	S.	S.	S.	M.	S.
24	S.	G.	S.	S.	S.	S.	C.	S.	S.	S.	M.	M.
25	C.	S.	M.	S.	C.	C.	S.	C.	S.	C.	S.	C.
26	C.	S.	M.	S.	C.	C.	S.	C.	C.	M.	S.	C.
27	C.	S.	S.	S.	S.	S.	S.	C.	C.	M.	S.	C.
28	C.	S.	S.	C.	M.	S.	S.	C.	C.	M.	S.	C.
29	S.		C.	C.	M.	S.	S.	S.	M.	M.	S.	C.
30	C.		M.	S.	S.	S.	S.	S.	M.	S.	S.	S.
31	C.		S.		S.		S.	S.		S.		C.
Totals... C.	7	1	1	4	6	6	7	15	14	7	8	16
S.	16	16	18	20	22	21	22	15	10	14	15	11
M.	8	8	10	5	2	3	2	1	6	10	5	3
G.	0	3	2	1	1	0	0	0	0	0	2	1
V.G.	0	0	0	0	0	0	0	0	0	0	0	0

Disturbances determined from Horizontal Force traces.

C. = calm; S. = small; M. = moderate; G. = great; V.G. = very great.

Days reckoned from 10 A.M. to 10 A.M. of the following day.

TABLE III.—*Dates of Magnetic Disturbances, 1896.*

1896. Date.	MONTH. January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1	C.	M.	S.	S.	S.	C.	C.	M.	C.	M.	C.	S.
2	M.	M.	S.	S.	V.G.	C.	C.	M.	S.	S.	C.	C.
3	M.	M.	S.	S.	V.G.	S.	M.	M.	M.	S.	C.	M.
4	M.	M.	G.	S.	S.	C.	M.	S.	S.	S.	S.	M.
5	M.	S.	S.	S.	S.	S.	M.	C.	S.	S.	M.	S.
6	M.	S.	S.	C.	S.	C.	M.	M.	S.	C.	G.	S.
7	M.	C.	M.	C.	S.	S.	S.	M.	S.	C.	G.	C.
8	S.	S.	C.	S.	S.	M.	C.	S.	S.	S.	M.	C.
9	M.	S.	S.	S.	S.	M.	C.	S.	S.	M.	M.	C.
10	S.	S.	S.	S.	S.	S.	S.	S.	S.	M.	S.	S.
11	S.	S.	S.	S.	S.	S.	M.	S.	S.	G.	C.	S.
12	S.	S.	M.	S.	M.	C.	S.	S.	S.	G.	S.	C.
13	S.	M.	S.	C.	S.	S.	S.	C.	S.	M.	C.	M.
14	M.	M.	S.	S.	S.	M.	S.	C.	S.	S.	S.	S.
15	S.	S.	S.	C.	S.	C.	S.	C.	S.	S.	S.	S.
16	S.	S.	C.	C.	S.	M.	S.	C.	S.	S.	S.	C.
17	M.	S.	C.	S.	M.	S.	C.	M.	M.	S.	S.	S.
18	S.	S.	C.	S.	M.	S.	C.	S.	V.G.	S.	S.	C.
19	M.	S.	C.	C.	S.	S.	C.	S.	S.	S.	S.	C.
20	M.	C.	S.	S.	M.	C.	S.	M.	M.	S.	S.	C.
21	S.	S.	S.	M.	S.	C.	S.	S.	S.	S.	S.	C.
22	S.	C.	S.	M.	S.	C.	C.	S.	S.	S.	C.	C.
23	S.	S.	S.	M.	S.	C.	M.	S.	S.	S.	C.	C.
24	C.	S.	C.	M.	S.	C.	S.	S.	S.	S.	C.	C.
25	S.	S.	S.	M.	S.	S.	M.	S.	S.	S.	C.	C.
26	C.	S.	M.	S.	C.	S.	S.	S.	C.	C.	S.	S.
27	S.	S.	M.	S.	C.	S.	M.	C.	C.	S.	S.	S.
28	C.	G.	M.	S.	C.	C.	C.	C.	S.	C.	S.	S.
29	S.	M.	S.	C.	S.	S.	C.	M.	S.	S.	C.	S.
30	M.		S.	S.	S.	S.	S.	S.	S.	S.	S.	S.
31	M.		M.		C.		S.	S.		C.		C.
Totals... C.	4	3	6	7	4	12	10	7	3	5	10	15
S.	14	18	18	18	21	14	13	16	23	20	15	13
M.	13	7	6	5	4	4	8	8	3	4	3	3
G.	0	1	1	0	0	0	0	0	0	2	2	0
V. G.	0	0	0	0	2	0	0	0	1	0	0	0

Disturbances determined from Horizontal Force traces.

C. = calm ; S. = small ; M. = moderate ; G. = great ; V.G. = very great.

Days reckoned from 10 A.M. to 10 A.M. of the following day.

TABLE IV.—Hourly Means of Declination, as determined from the selected quiet days in 1894.

(*The Mean for the year* = 0° 39′·4 *East.*)

Hours.	Preceding noon.	Mid.	1	2	3	4	5	6	7	8	9	10	11	Noon.	1	2	3	4	5	6	7	8	9	10	11	Mid.	Succeeding noon.
WINTER.																											
1894. Months.	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′
January ...	41·0	40·3	40·3	40·3	40·2	39·9	39·7	39·6	39·4	40·2	41·4	41·4	40·4	40·1	40·5	40·3	40·1	40·0	39·9	39·7	40·1	40·2	40·1	40·1	40·1	40·1	40·8
February ...	39·9	40·5	40·5	40·6	40·5	40·4	40·0	39·8	39·7	40·2	40·5	40·4	40·0	39·4	39·2	39·6	39·8	39·7	39·7	39·7	39·9	40·0	39·9	40·0	40·1	40·2	40·2
March ...	39·6	40·1	40·1	39·9	39·9	39·7	39·6	39·7	40·7	41·8	42·1	41·9	40·7	39·5	38·9	39·3	39·9	40·1	40·1	39·7	39·6	39·7	39·7	39·7	39·9	40·1	39·1
October ...	37·5	39·5	39·5	39·6	39·4	39·4	39·3	39·5	40·2	40·3	39·8	38·8	37·7	37·4	38·1	39·0	39·6	39·5	38·7	38·7	38·8	38·9	38·9	39·0	39·2	39·3	37·6
November ...	38·1	38·8	38·8	38·7	38·6	38·6	38·5	38·3	38·5	39·0	39·1	38·7	37·9	38·2	38·6	38·7	38·7	38·5	38·5	38·5	38·8	38·8	38·6	38·6	38·7	38·7	38·2
December ...	38·1	38·5	38·5	38·4	38·3	38·1	38·0	37·9	37·6	38·0	38·8	39·2	38·6	38·0	37·7	37·6	37·8	38·1	38·1	38·1	38·4	38·3	38·2	38·2	38·3	38·3	38·1
Mean ...	39·0	39·6	39·6	39·6	39·5	39·3	39·2	39·1	39·3	39·9	40·3	40·0	39·2	38·8	38·8	39·1	39·3	39·3	39·1	39·1	39·3	39·3	39·2	39·3	39·4	39·4	39·0
SUMMER.																											
	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′
April ...	38·4	40·0	40·1	40·1	40·1	40·0	40·1	40·8	41·9	42·0	41·0	39·9	38·6	37·6	37·6	38·1	38·8	39·5	39·6	39·6	39·6	39·7	39·8	39·9	40·0	40·0	37·9
May ...	37·0	39·7	39·8	40·0	39·9	39·9	40·1	41·3	41·9	41·5	40·2	38·8	37·7	37·0	37·4	37·9	38·5	39·4	39·7	39·5	39·1	39·1	39·2	39·4	39·5	39·6	36·9
June ...	37·5	39·5	39·7	39·6	39·7	39·8	40·2	41·3	41·9	41·9	40·8	39·8	38·3	37·2	37·1	37·4	38·1	38·9	39·5	39·7	39·0	38·9	39·1	39·2	39·2	39·4	37·4
July ...	38·5	39·6	39·6	39·7	39·8	40·0	40·6	42·0	42·3	41·9	40·5	39·2	38·1	37·7	37·5	38·2	38·8	39·1	39·5	39·5	38·9	38·9	39·0	39·1	39 3	39·4	37·9
August ...	37·5	39·4	39·4	39·6	39·6	39·8	40·3	41·8	42·4	41·8	40·0	38·5	37·5	37·0	37·5	38·0	39·1	39·8	40·1	39·6	39·1	39·0	39·0	39 1	39·2	39·4	36·7
September ...	36·3	39·6	39·8	39·8	39·8	39·8	40·1	41·2	42·1	41·5	39·9	38·6	37·3	36·7	37·1	38·1	39·2	39·7	39·6	39·3	39·0	39·0	39·1	39·2	39·4	39·5	36 0
Mean ...	37·5	39·6	39·8	39·8	39·8	39·9	40·2	41·4	42·1	41·7	40·4	39·1	37·9	37·2	37·4	37·9	38·8	39·4	39·7	39·5	39·1	39·1	39·2	39·3	39·4	39·6	37·1

TABLE V.—Diurnal Inequality of the Colaba Declination as derived from Table IV.

Hours.	Mid.	1	2	3	4	5	6	7	8	9	10	11	Noon.	1	2	3	4	5	6	7	8	9	10	11	Mid.
SUMMER MEAN.																									
	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′
	+0·1	+0·3	+0·3	+0·3	+0·4	+0·7	+1·9	+2·6	+2·2	+0·9	−0·3	−1·6	−2·3	−2·1	−1·5	−0·7	−0·1	+0·2	0·0	−0·4	−0·4	−0·3	−0·2	−0·1	+0·1
WINTER MEAN.																									
	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′
	+0·3	+0·3	+0·2	+0·1	0·0	−0·2	−0·2	0·0	+0·5	+0·9	+0·7	−0·1	−0·6	−0·5	−0·3	−0·1	0·0	−0·2	−0·3	−0·1	0·0	−0·1	−0·1	0·0	+0·1
ANNUAL MEAN.																									
	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′
	+0·2	+0·3	+0·2	+0·2	+0·2	+0·3	+0·8	+1·3	+1·4	+0·9	+0·2	−0·9	−1·4	−1·3	−0·9	−0·4	−0·1	0·0	−0·1	−0·2	−0·2	−0·2	−0·1	0·0	+0·1

NOTE.—When the sign is + the magnet points to the East of its mean position.

TABLE VI.—Hourly Means of Declination, as determined from the selected quiet days in 1895.

(*The Mean for the year*=0° 37′·0 *East.*)

Hours.	Preceding noon.	Mid.	1	2	3	4	5	6	7	8	9	10	11	Noon.	1	2	3	4	5	6	7	8	9	10	11	Mid.	Succeeding noon.
WINTER.																											
1895. Months.	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′
January ...	38·2	38·0	38·1	38·2	38·0	37·8	37·5	37·1	37·3	38·4	39·0	39·0	38·3	38·1	38·6	38·7	38·7	38·3	37·7	37·8	38·0	38·0	37·9	38·0	38·0	37·9	37·9
February ...	37·6	38·3	38·3	38·3	38·1	37·9	37·7	37·5	37·7	38·3	38·6	38·2	37·4	37·3	37·7	38·0	38·3	38·4	37·9	37·4	37·8	37·9	37·9	37·9	38·1	38·1	37·6
March ...	36·4	38·0	38·1	38·0	37·9	37·8	37·9	38·2	39·0	39·5	39·5	38·7	37·0	35·9	35·9	36·8	37·8	38·4	37·9	37·5	37·8	37·8	37·8	37·8	37·9	38·0	36·5
October ...	34·4	36·7	36·8	36·8	36·6	36·5	36·6	37·0	37·6	37·6	36·6	35·7	34·7	34·5	35·3	36·2	36 9	36·9	36·2	36·1	36·2	36·4	36·3	36·4	36·5	36·5	35·4
November ...	36·8	36·7	36·7	36·7	36·7	36·4	36·1	35·8	36·0	36·6	36·9	36·6	36·3	36·2	36·3	36·3	36·2	36·3	36·2	36·2	36·3	36·2	36·2	36·3	36·5	36·5	36·8
December ...	36·5	36·0	35·9	35·9	35·7	35·5	36·3	35·2	34·9	35·4	35·8	35·9	36·1	36·3	36·6	36·5	36·0	35·9	36·0	36·0	36·2	36·2	36·1	36 0	36·1	36·0	36·1
Mean	36·7	37·3	37·3	37·3	37·2	37·0	36·9	36·8	37·1	37·6	37·7	37·4	36·6	36·4	36 7	37·1	37·3	37·4	37·0	36·8	37·0	37·1	37·0	37·1	37·2	37·2	36·7
SUMMER.																											
	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′
April	35·2	37·8	37·8	37·7	37·6	37·6	37·9	38·7	39·7	39·9	39·1	37·9	36·3	35·3	35·1	35·8	36·7	37·4	37·6	37·3	37·1	37·2	37·4	37·5	37·5	37·6	35·0
May	35·1	37 7	37·9	37·9	37·9	37·9	38·3	39·2	39·8	39·6	37·7	36·2	35·3	35·0	35·6	36·8	37·7	38 4	38·1	37·6	37·1	36·9	37·1	37·2	37·4	37·5	34·7
June	34·7	37·4	37·5	37 5	37·5	37·4	37·8	39·3	40·2	40·5	38·8	36·9	35·7	34·8	34·0	34·4	35·6	36·7	37·3	36·9	36·7	36·6	36·8	37·0	37·2	37·3	34·2
July	35·1	37·1	37·1	37·1	37·3	37 4	37·9	39·1	39·4	39·2	37·9	36·3	34·8	34·5	34·6	35·2	35·8	36·7	37·1	37·0	36·8	36·2	36·2	36·2	36·4	36·5	34·5
August ...	34·3	36·5	36·7	36·8	36·8	37·0	37·4	38·7	39·5	38·8	37·0	35·4	34·5	34·3	34·7	35·3	36·2	36·7	36·9	36·5	36·2	36·2	36·3	36·4	36·5	36·6	34·8
September ...	33·5	36·5	36·5	36·4	36·4	36·5	36·8	38·0	38·6	38·0	36·4	35·0	33·7	33·2	33·8	35·1	36·3	37·0	36·8	36·6	36·4	36·3	36·2	36·3	36·4	36·5	33·9
Mean	34·6	37·2	37·3	37·2	37·2	37·3	37·7	38·8	39·6	39·3	37·8	36·3	35·1	34·4	34·6	35·4	36·4	37·1	37·2	37·0	36·6	36·6	36·7	36·8	36·9	37·0	34·4

TABLE VII.—Diurnal Inequality of the Colaba Declination as derived from Table VI.

Hours.	Mid.	1	2	3	4	5	6	7	8	9	10	11	Noon.	1	2	3	4	5	6	7	8	9	10	11	Mid.
SUMMER MEAN.																									
	′ +0·2	′ +0·3	′ +0·3	′ +0·3	′ +0·4	′ +0·7	′ +1·9	′ +2·6	′ +2·4	′ +0·8	′ −0·6	′ −1·9	′ −2·5	′ −2·3	′ −1·5	′ −0·6	′ +0·2	′ +0·4	′ 0·0	′ −0·3	′ −0·4	′ −0 3	′ −0·1	′ 0·0	′ +0·1
WINTER MEAN.																									
	′ +0·2	′ +0·2	′ +0·2	′ +0·1	′ −0·1	′ −0·2	′ −0·3	′ 0·0	′ +0·5	′ +0·6	′ +0·3	′ −0·5	′ −0·7	′ −0·3	′ 0·0	′ +0·2	′ +0·3	′ −0·1	′ −0·2	′ 0·0	′ 0·0	′ 0·0	′ 0·0	′ 0·0	′ +0·1	′ +0·1
ANNUAL MEAN.																									
	′ +0·2	′ +0·3	′ +0·2	′ +0·2	′ +0·1	′ +0·2	′ +0·8	′ +1·3	′ +1·4	′ +0·7	′ −0·2	′ −1·2	′ −1·6	′ −1·3	′ −0·8	′ −0·2	′ +0·2	′ +0·1	′ −0·1	′ −0·2	′ −0·2	′ −0·1	′ −0·1	′ 0·0	′ +0·1

Note.—When the sign is + the magnet points to the East of its mean position.

TABLE VIII.—Hourly Means of Declination, as determined from the selected quiet days in 1896.

(*The Mean for the year* = 0° 35′0 *East.*)

Hours.	Preced. ing noon.	Mid.	1	2	3	4	5	6	7	8	9	10	11	Noon.	1	2	3	4	5	6	7	8	9	10	11	Mid.	Succeed ing noon
WINTER.																											
1896. Months.	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′
January ...	35·4	35·7	35·6	35·5	35·4	35·1	34·8	34·8	34·8	35·5	36·3	36·2	35·5	35·2	35·3	35·3	35·5	36·0	35·7	35·7	35·8	35·8	35·8	35·8	35·8	35·8	35·8
February ...	35·6	35·8	35·7	35·6	35·4	35·3	35·3	35·2	35·4	36·3	36·7	36·6	36·0	35·4	36·1	35·1	35·7	35·8	35·6	35·6	35·7	35·9	35·8	35·8	35·8	35·7	35·2
March	34·8	36·2	36·1	36·0	36·0	35·9	35·9	36·2	36·7	36·9	36·5	35·9	34·9	34·4	34·6	35·3	36·2	36·8	36·1	35·8	35·7	35·7	35·6	35·7	35·9	35·8	35·1
October	33·4	35·1	35·0	35·0	34·9	34·8	34·8	35·1	35·6	35·9	35·6	35·2	34·3	34·1	34·5	35·1	35·6	35·5	34·9	34·8	34·7	34·7	34·7	34·8	34·8	34·9	34·6
November ...	33·8	34·6	34·6	34·5	34·4	34·3	34·2	34·1	34·1	34·6	34·6	34·2	33·5	33·5	33·9	34·4	34·6	34·6	34·3	34·3	34·4	34·4	34·4	34·8	34·4	34·4	34·0
December ...	33·7	34·2	34·2	34·1	34·0	33·8	33·7	33·6	33·1	33·5	33·7	33·8	33·6	33·7	34·0	34·1	34·4	34·5	34·2	34·3	34·2	34·1	34·1	34·0	34·0	34·0	33·2
Mean	34·4	35·3	35·2	35·1	35·0	34·9	34·8	34·8	35·0	35·4	35·6	35·3	34·6	34·4	34·6	34·9	35·3	35·4	35·1	35·1	35·1	35·1	35·1	35·1	35·1	35·1	34·6
SUMMER.																											
April	33·9	36·2	36·3	36·3	36·0	36·0	36·0	36·7	37·6	37·8	37·3	35·7	34·3	33·5	33·5	34·0	34·9	35·6	35·7	35·6	35·4	35·4	35·6	35·7	35·8	35·9	33·7
May	33·0	36·0	36·1	36·0	36·0	36·2	36·6	37·8	38·4	38·1	36·9	35·5	34·5	34·0	34·0	34·8	35·6	36·2	36·1	35·5	35·1	35·1	35·3	35·5	35·7	35·9	33·4
June	33·6	35·1	35·3	35·4	35·4	35·5	35·9	36·7	37·1	36·6	35·7	35·2	34·0	33·5	33·5	33·7	34·4	35·0	35·0	34·9	34·6	34·4	34·5	34·8	34·9	35·1	33·2
July	32·8	34·8	34·9	34·9	34·9	35·0	35·2	36·1	36·5	36·4	35·9	35·1	34·2	33·1	32·5	33·0	34·0	34·8	35·0	34·8	34·3	34·3	34·4	34·6	34·6	34·7	33·1
August	32·1	34·6	3·7	34·7	34·8	34·8	35·1	36·2	37·2	36·8	35·4	34·0	32·7	31·9	32·2	33·4	34·4	34·9	35·0	34·6	34·4	34·2	34·2	34·8	34·4	34·5	32·1
September ...	32·0	34·9	3·9	35·0	34·9	34·8	35·0	35·9	36·6	36·3	34·9	33·7	32·4	31·5	31·7	32·9	34·2	34·7	34·8	34·5	34·3	34·4	34·4	34·6	34·6	34·7	31·8
Mean	32·9	35·3	35·4	35·4	35·3	35·4	35·6	36·6	37·2	37·0	36·0	34·9	33·7	32·9	32·9	33·6	34·6	35·2	35·3	35·0	34·7	34·6	34·7	34·9	35·0	35·1	32·9

TABLE IX.—Diurnal Inequality of the Colaba Declination, as derived from Table VIII.

Hours.	Mid.	1	2	3	4	5	6	7	8	9	10	11	Noon.	1	2	3	4	5	6	7	8	9	10	11	Noon.
SUMMER MEAN.																									
	′ +0·2	′ +0·3	′ +0·4	′ +0·3	′ +0·3	′ +0·6	′ +1·5	′ +2·2	′ +2·0	′ +1·0	′ −0·1	′ −1·4	′ −2·1	′ −2·1	′ −1·4	′ −0·4	′ +0·1	′ +0·2	′ 0·0	′ −0·4	′ −0·4	′ −0·3	′ −0·1	′ 0·0	′ +0·1
WINTER MEAN.																									
	′ +0·2	′ +0·1	′ 0·0	′ 0·0	′ −0·2	′ −0·3	′ −0·2	′ −0·1	′ +0·4	′ +0·5	′ +0·2	′ −0·4	′ −0·7	′ −0·5	′ −0·2	′ +0·3	′ +0·4	′ +0·1	′ 0·0	′ 0·0	′ 0·0	′ 0·0	′ 0·0	′ 0·0	′ 0·0
ANNUAL MEAN.																									
	′ +0·2	′ +0·2	′ +0·2	′ +0·1	′ +0·1	′ +0·1	′ +0·6	′ +1·0	′ +1·2	′ +0·7	′ 0·0	′ −0·9	′ −1·4	′ −1·8	′ −0·8	′ −0·1	′ +0·3	′ +0·1	′ 0·0	′ −0·1	′ −0·2	′ −0·1	′ 0·0	′ 0·0	′ +0·1

Note.—When the sign is + the magnet points to the East of its mean position.

APPENDIX C.

DINES' PRESSURE TUBE ANEMOMETER.

This instrument by R. W. Munro of London was received in January 1897 and fitted up in February on the same tower on which the old Robinson Beckley Anemograph is fixed, and it has been in action since then. The fixture is so arranged that one instrument does not in any way interfere with the action of the other. The anemograph is fixed about 3 feet high centrally on a flat platform on the top of the old Time Ball Tower, and the pressure tube anemometer is located on the edge of this platform on the north-east side—the distance between the two instruments being the radius of the platform—about 6 feet. The vane of the latter is placed about 6 feet above the platform, so that it is about 3 feet above the level of the cups of the anemograph. The tower is 53 feet high from the ground and 95 feet above mean sea-level and, looking at the exposed position of the tower, the two instruments have been placed in as identically analogous conditions as was possible under the circumstances. The situation of the Observatory as described elsewhere, and surrounded as it is on three sides by the sea, ensures that the instruments are fully and equally exposed to the force of the winds which come from over the sea and from landwards, there being no neighbouring objects which can appreciably affect the force and direction of wind on either of the two instruments at Colába The Robinson Beckley Anemograph is also by R. W. Munro of London and, though now in use for 30 years, works uniformly regular and rarely gives trouble. The centres of each pair of opposite cups are four feet apart, the diameter of the cups being 9".

2. The new instrument requires no special description, as it is of precisely the same type as described in the Quarterly Journal of the Royal Meteorological Society Volume XVIII. The air-tight vessel with its float, recording cylinder, &c., is placed in the centre of the first floor of the tower on a stone pillar, the vertical distance between the head and the recording apparatus being about 34 feet and the horizontal distance being equal to the radius of the tower—6 feet. The composition tubes, each 40 feet long, are led from the vane to the cylinder by gentle curves, and from the relative positions of the head and the recording cylinder no sharp bends whatever have been introduced. The instrument when levelled and adjusted requires about from 50 to 95 grains in the cup to just sink the pen to zero of scale depending upon the temperature and pressure of the day. A large shot weighing about 16 grains is always used for final adjustment, removal of this from the cup showing a rise of the pen equal to about half a mile on the scale. The final adjustment of the Dines' instrument is performed every day with precision, and any serious departure from the weights which cannot be explained by a fall or rise of temperature and pressure is guarded against. The fluctuations in the weights are noted down daily (this is done by keeping a stock of small and large shots of known weights) and thus an efficient check is kept upon the regular and uniform working of the instrument.

3. A small variation in the constant, whatever it may be, between the two instruments for larger as well as for smaller velocities would be a good test of the regular and uniform performance of both the instruments, and the results show that they worked evenly and uniformly during the period under examination. That this period—about 8 months—is too short for any general conclusions to be drawn, is obvious; but it must be noted at the same time that the period embraces almost all kinds of different characters of wind. It includes calm and windy and stormy days, days of steady and gusty wind, as also days on which the variation of direction was violent and on which it was steady. An analysis of the whole, as shown by the tables, gives us some idea as to how far one instrument can be relied upon to indicate the results of the other, final results and discussions being reserved until data of sufficiently long period have accumulated.

4. A thermometer is attached to the instrument. The temperature and pressure ranged during the period of observation between the limit 63° and 94° and 29·421 in. and 30·037 in. respectively.

5. The general result as shown in Table I gives 2·06 as the factor of Robinson Beckley's Anemograph. The factor ranges from 2·10 for light winds to 2·03 for velocities of 21 miles and above.

6. The result of days during which the wind was steady in direction gives a lower factor 2·07, while that of days of variable direction gives 2·11.

7. The general results of Tables IV and V give 2·05 for steady intensity and 2·07—a higher factor—for gusty winds. Higher velocities generally show a slightly lower factor.

TABLE I.—*Comparison of Records of Dines' and Robinson Beckley's Anemographs.*

	Velocity of wind by Robinson and Beckley's anemograph between the limits																General result of all values.			
	1 to 5 miles.				6 to 10 miles.				11 to 20 miles.				21 miles and above.							
	Number of Observations.	Average Velocity by Robinson's.	Average Velocity by Dines'.	Factor.	Number of Observations.	Average Velocity by Robinson's.	Average Velocity by Dines'.	Factor.	Number of Observations.	Average Velocity by Robinson's.	Average Velocity by Dines'.	Factor.	Number of Observations.	Average Velocity by Robinson's.	Average Velocity by Dines'.	Factor.	Number of Observations.	Average Velocity by Robinson's.	Average Velocity by Dines'.	Factor.
February 1897 ...	56	3·9	2·7	2·10	94	7·8	5·4	2·06	102	13·6	9·5	2·10	15	22·3	15·7	2·11	267	10·0	7·0	2·09
March „ ...	210	3·8	2·8	2·21	243	8·0	5·6	2·11	229	14·5	10·3	2·15	18	21·7	15·2	2·11	700	9·2	6·6	2·14
April „ ...	163	3·5	2·6	2·19	242	7·8	5·6	2·15	266	14·5	10·4	2·16	42	22·4	16·0	2·15	713	10·2	7·3	2·16
May „ ...	207	3·9	2·8	2·13	307	7·9	5·5	2·08	221	13·7	9·7	2·12	7	22·3	16·1	2·17	742	8·6	6·1	2·11
June „ ...	52	4·3	2·9	2·05	141	8·1	5·6	2·07	437	14·6	9·9	2·03	75	24·8	17·1	2·06	705	13·7	9·3	2·04
July „ ...	18	4·3	2·9	2·04	196	8·5	5·9	2·08	440	15·4	10·5	2·04	90	23·7	16·1	2·04	744	14·3	9·8	2·05
August „ ...	14	4·3	2·6	1·85	153	8·6	5·5	1·93	427	14·7	9·7	1·98	145	24·1	15·7	1·96	739	15·1	9·9	1·97
September „ ...	118	3·9	2·3	1·81	272	8·2	5·5	2·00	298	13·6	9·3	2·04	15	21·6	14·7	2·04	703	10·0	6·7	2·01
February to Sept....	838	3·8	2·7	2·10	1,648	8·1	5·6	2·07	2,420	14·5	10·0	2·06	407	23·7	16·0	2·03	5,313	11·5	7·9	2·06

TABLE II.—*Days of Steady Direction.*

	Velocity of wind by Robinson and Beckley's Anemograph between the limits.															General result of all values.			
	1 to 5 miles.				6 to 10 miles.				11 to 20 miles.				21 miles and above.							
	Number of Observations.	Average Velocity by Robinson's.	Average Velocity by Dines'.	Factor.	Number of Observations.	Average Velocity by Robinson's.	Average Velocity by Dines'.	Factor.	Number of Observations.	Average Velocity by Robinson's.	Average Velocity by Dines'.	Factor.	Number of Observations.	Average Velocity by Robinson's.	Average Velocity by Dines'.	Factor.	Number of Observations.	Average Velocity by Robinson's.	Average Velocity by Dines'.	Factor.
February 1897 ...	9	3·4	2·3	2·03	7	6·6	4·4	2·02	5	12·6	8·6	2·05					21	6·7	4·5	2·04
March „ ...	118	3·6	2·5	2·14	130	8·1	5·7	2·10	95	13·9	9·9	2·14	4	22·5	15·5	2·07	347	8·3	5·9	2·12
April „ ...	50	3·2	2·4	2·28	70	7·8	5·6	2·15	67	13·9	10·0	2·15	2	21·0	15·0	2·14	189	8·9	6·4	2·17
May „ ...	52	4·0	2·8	2·13	99	7·8	5·3	2·01	41	12·6	8·5	2·03					192	7·8	5·3	2·03
June „ ...	9	4·1	3·0	2·19	32	8·3	5·7	2·04	127	14·8	10·1	2·04					168	13·0	8·8	2·04
July „ ...					26	8·7	5·9	2·02	22	12·5	8·1	1·96					48	10·4	6·9	1·99
August „ ...	1	5·0	3·0	1·80	30	8·7	5·5	1·88	17	12·4	7·8	1·88					48	9·9	6·2	1·88
September „ ...	32	4·0	2·4	1·83	52	7·6	5·0	1·96	11	12·4	8·1	1·96					95	6·9	4·5	1·93
February to Sept. ...	271	3·6	2·6	2·12	446	8·0	5·5	2·05	385	13·8	9·5	2·07	6	22·0	15·3	2·09	1,108	9·0	6·2	2·07

TABLE III.—*Days of Variable Direction.*

February* 1897 ...																			
March* „ ...																			
April „ ...	7	3·9	2·9	2·22	19	8·2	5·9	2·17	21	12·7	9·1	2·15					47	9·6	6·9	2·16
May „ ...	16	3·9	2·8	2·14	16	7·6	5·5	2·16	16	13·1	9·6	2·20					48	8·2	6·0	2·18
June „ ...	15	4·5	2·9	1·92	32	7·7	5·4	2·09	37	14·0	9·9	2·13	4	25·7	18·7	2·18	88	10·6	7·5	2·11
July „ ...	5	4·4	2·8	1·91	45	8·4	5·8	2·08	59	14·7	10·4	2·12	11	24·5	16·5	2·03	120	12·8	8·9	2·09
August* „ ...																			
September „ ...	27	3·7	2·4	1·94	32	7·8	5·2	2·00	34	13·1	9·3	2·11	1	21·0	16·0	2·29	94	8·7	6·0	2·06
February to Sept. ...	70	4·0	2·7	2·01	144	8·0	5·6	2·09	167	13·8	9·8	2·13	16	24·6	17·1	2·08	397	10·4	7·3	2·11

* During all the days of the month the wind was of steady direction.

TABLE IV.—*Days of Steady Intensity.*

	Velocity of wind by Robinson and Beckley's anemograph between the limits.																General result of all values.			
	1 to 5 miles.				6 to 10 miles.				11 to 20 miles.				21 miles and above.							
	Number of Observations.	Average Velocity by Robinson's.	Average Velocity by Dines'.	Factor.	Number of Observations.	Average Velocity by Robinson's.	Average Velocity by Dines'.	Factor.	Number of Observations.	Average Velocity by Robinson's.	Average Velocity by Dines'.	Factor.	Number of Observations.	Average Velocity by Robinson's.	Average Velocity by Dines'.	Factor.	Number of Observations.	Average Velocity by Robinson's.	Average Velocity by Dines'.	Factor.
February 1897 ...	9	4·2	2·8	1·97	5	7·4	4·8	1·95	9	12·2	8·4	2·07					23	8·0	5·4	2·03
March „ ...	59	3·4	2·5	2·17	54	8·3	5·8	2·10	20	11·6	7·8	2·01					133	6·6	4·6	2·09
April „ ..	25	3·4	2·7	2·37	29	7·8	5·9	2·26	18	12·7	9·4	2·22					72	7·5	5·7	2·26
May „ ...	15	4·3	3·0	2·08	27	7·5	4·8	1·93	6	12·0	7·8	1·96					48	7·1	4·6	1·96
June * „ ...																				
July * „ ..																				
August „ ..	8	4·1	2·6	1·91	34	8·1	5·1	1·88	6	11·5	7·3	1·91					48	7·9	5·0	1·89
September „ ..	55	4·0	2·4	1·78	93	7·9	5·3	2·02	37	13·1	9·2	2·10	1	21·0	14·0	2·00	186	7·9	5·3	2·01
February to Sept. ..	171	3·7	2·5	2·03	242	8·0	5·4	2·04	96	12·5	8·7	2·08	1	21·0	14·0	2·00	510	7·4	5·1	2·05

* During all the days of the month the wind was of variable intensity.

TABLE V.—*Days of Variable Intensity.*

February 1897 ...	1	4·0	3·0	2·25	11	9·1	6·1	2·01	15	14·9	10·7	2·14	15	22·3	15·7	2·11	42	15·8	11·1	2·11
March „ ...	27	4·6	3·5	2·26	69	8·2	5·7	2·09	103	15·8	11·5	2·18	17	21·7	15·3	2·11	216	12·4	8·9	2·15
April „ ...	42	3·8	2.8	2·21	69	7·8	5·6	2·16	117	15·7	11·5	2·20	35	22·5	16·2	2·17	263	12·6	9·2	2 19
May „ ...	26	3·8	2·9	2·30	33	7·9	5·6	2·11	54	15·1	11·2	2·22	7	22·3	16·1	2·17	120	11·1	8·1	2·20
June „ ...	13	4·3	2·8	1·93	44	8·4	5·9	2·13	286	15·1	10·3	2·04	75	24·8	17·1	2·06	418	15·8	10·8	2·05
July „ ...	11	4·4	2·8	1·94	86	8·4	5·8	2·07	319	16·0	11·0	2·06	88	23·7	16·1	2·04	504	15·8	10·8	2·06
August „ ...	1	5·0	3·0	1·80	22	9·7	6·5	2·03	223	15·3	10·2	2·01	114	24·4	16·0	1·97	360	17·8	11·8	1·99
September „ ..	2	4·0	2·0	1·50	17	8·5	5·8	2·03	48	14·0	9·4	2·01	4	21·2	14·5	2·05	71	12·8	8·6	2·01
February to Sept....	123	4·1	3·0	2·17	351	8·3	5·8	2·09	1,165	15·5	10·7	2·08	355	23·8	16·2	2·04	1,994	15·0	10·3	2·07

TABLE VI.—*Average Hourly Intensity of Wind recorded by Dines' Anemograph.*

In Miles per Hour.

1897.	Colaba Civil Hours.																							Monthly mean.
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
March	5·9	5·2	4·4	4·1	3·7	4·0	3·8	3·9	4·3	4·5	5·1	7·1	8·5	9·7	10·7	11·2	11·0	10·2	9·0	7·5	5·7	4·9	5·4	5·8	6·5
April	6·0	5·3	4·5	4·5	4·1	3·9	4·1	4·8	6·2	6·4	7·0	8·2	9·5	11·0	12·0	12·1	11·8	11·0	9·6	8·3	6·8	5·9	5·6	5·7	7·3
May	3·9	4·0	3·7	3·6	3·4	3·8	3·9	4·8	5·3	5·5	6·3	7·5	8·3	9·2	9·9	10·5	9·9	8·3	7·1	6·3	5·8	5·4	4·7	4·2	6·1
June	9·6	9·2	8·6	8·8	8·5	8·8	8·9	8·7	8·8	8·3	8·6	8·5	9·1	10·0	9·6	9·9	10·1	10·4	9·9	9·9	9·7	10·2	10·2	9·8	9·3
July	10·1	10·1	9·6	9·6	9·8	9·4	9·4	9·3	8·8	8·5	10·0	10·4	10·4	9·6	9·4	9·5	10·3	10·6	10·7	10·2	10·1	9·5	9·4	10·0	9·8
August	10·3	9·9	10·1	10·3	10·1	10·3	10·1	10·4	10·0	9·6	9·6	9·5	9·8	10·3	10·3	10·4	10·8	9·9	9·4	9·5	9·3	9·2	9·1	9·6	9·9
September	6·8	6·0	5·8	5·7	5·9	5·8	6·5	7·0	7·0	7·0	6·7	6·6	6·8	7·8	8·1	8·4	8·0	7·6	7·2	6·2	6·3	5·7	5·6	6·0	6·7
March to May	5·3	4·8	4·2	4·1	3·7	3·9	3·9	4·5	5·3	5·5	6·1	7·6	8·8	10·0	10·9	11·3	10·9	9·8	8·6	7·4	6·1	5·4	5·2	5·2	6·6
June to September	9·2	8·8	8·5	8·6	8·6	8·6	8·7	8·8	8·6	8·3	8·7	8·7	9·0	9·4	9·3	9·5	9·8	9·6	9·3	8·9	8·8	8·6	8·6	8·8	8·9

APPENDIX D.

Adjustment of Grubb's Declinometer.

It is the practice in this Observatory to take absolute observations of declination every Thursday by the Kew Unifilar Magnetometer No. 23 (Elliott Bros.) About the end of August these observations showed a somewhat marked disagreement with the readings of the Grubb's declinometer which are taken concurrently at the time of absolute observations. This irregularity led to the examination of the transit telescope of the declinometer which was first suspected. From observations of Polaris, however, it was ascertained that the instrument was in perfect adjustment. It was then thought that the observers were perhaps careless in their observations of absolute determinations, especially in regard to torsion. But on further investigation it was found that the variation was considerable, and from its character it appeared that the mischief lay elsewhere than in error due to want of attention to torsion in absolute determinations. As nothing apparently seemed wrong with the Grubb's declinometer itself which was examined for cobwebs, as its previous history showed it was twice so affected by such attachments, records of magnetograph, declinometer and absolute observations of the whole year were called for and the readings tabulated side by side for examination—the scale readings of the two former being duly converted into arcs by constants freshly determined. Certain inferences were now drawn as will be seen from the life history of the instrument which follows. One inference of which was that somewhere about the end of August a sudden change had taken place in the readings of the Grubb's instrument and the fault appeared to lie with that instrument. This led to a more careful inspection of this instrument, and on close examination it was found that several of the silk fibres (about 52 in all formed the whole skein) had broken and a few were touching the sides of the glass tube at the bottom where it enters the wooden top of the box, but just out of sight. The instrument was adjusted and closed in 1861, and seeing that in the experience of this and other observatories a too frequent disturbance of the adjustment of the instrument of this class had been found fatal to accurate determination of secular variation, except a very careful watch on the instrument and its indications, no attempt at interfering with its inner arrangements even for cleaning purposes was made at any time, beyond the usual careful monthly examination of the instrument by the First Assistant, who alone was permitted to touch the instrument. Thus for 35 years the instrument was allowed to remain undisturbed and during that period the glass tube enclosing the suspension skein had got so dimmed from inside that the silk skein, though visible, was not sharply defined. It was on this account that the broken fibres, which were besides not quite in sight, as stated before, were not noticed previously, the mischief being detected by the indirect method referred to above. On finding that these broken fibres impeded the free motion of the magnet, it was resolved at once to dismount the instrument and to re-adjust it. Of the many possible causes to which the breakage may be ascribed one at least seemed plausible from the few short broken stumps of fibres found near the top head screw, which showed exactly where the breakage had occurred. This was found to be just at the hole in the cross piece through which the skein passed after leaving the head screw. This hole being not exactly under the side of the screw, it did not allow the skein to pass vertically through, but an angle of about 20° was made and the friction between the skein and the sharp edge of the hole appeared to have been the very probable cause of the rupture. It must here also be noted that after the heavy fall in the first three weeks of August, the rains suddenly ceased—an exceptional feature in the weather—which affecting the moisture in the atmosphere may perhaps have been the last straw which caused the final breakage. *It will further be seen later on that the mischief appears to have primarily commenced in so far back as 1894*, when perhaps a few fibres had broken very low down and at such places as not to allow of the broken fibres to separate from the bunch, the only effect being a reduction of the torsion of skein and consequent *reduction* of the reading.* The last observation was taken on Saturday 17th October at about noon, which when compared to the corresponding absolute determination and the magnetograph readings when reduced showed an error of about 3½ minutes. The box was opened and the glass cover over the torsion head scale was removed. When the skein was taken out, it was found that some 11 fibres had broken.

* *Vide* History of Grubb's, Appendix E.

The following details of the dimensions, &c., were taken down :—

Length of bar magnet...	...	15·00 inches.
Breadth=...	...	·86 „
Thickness= ..'	...	·25 „
Weight=	...	8,236·5 grains.
Distance between scale and lens	...	13·1 inches.
Torsion circle reading, vernier B....		274° 27′

The whole instrument and its parts were thoroughly cleaned. It had been resolved to try, if practicable, the experiment of substituting a quartz fibre for the bundle of silk fibres, but as none was immediately available, silk suspension was as a provisional measure again resorted to.* A large length of raw unspun silk without any flaw was selected. Two glass rods were taken and placed about 38 in. apart and the silk was wound round them from one rod to another, each turn being laid as near as possible to its neighbour on the glass rods. Twenty such double turns were taken and the ends securely knotted. By a careful manipulation of the rods the turns were brought closer and closer to each other until the breadth occupied by the 20 (double) turns of the fibres occupied less than a third of an inch of space on the glass rods. Two short pieces of silk were now taken and a knot tied quickly one at each end under the rods gathered all the fibres together in a bunch in which each fibre lay straight and parallel (without entanglement) to its neighbour. A weight was hung at one end and the prepared skein was allowed to stretch for some hours before use.

2. The detorsion box which was laid aside in 1861 and never since used was obtained. The bar was found to be in order except that a small twist in the stirrup with reference to the bar was observed. The lens was in position, but the glass collimator scale was found missing from the frame of the slider. The sliding piece with its glass scale belonging to the bar magnet had therefore to be removed from the bar magnet and used on the detorsion bar. This introduced considerable difficulties in the proper adjustment and which, as will be seen later on, somewhat altered the order of the different stages of adjustment as described in the report of the Royal Society (1840). As the lens of the detorsion bar appeared not to have the same focal length as that of the lens on the magnet, no attempt was made that day to adjust the same beyond balancing the bar. The various parts of the instrument being cleaned, the skein was knotted to the stirrup bar at one end and the other end was wound up carefully on the head screw of the torsion circle—the cross piece through a hole in which the skein passed into the glass tube being previously adjusted in its proper position. The detorsion bar was now attached to the stirrup bar and the instrument was closed for the night. Prior to this the bar magnet had been suspended to adjust the exact length of the skein so as to allow of the scale being seen through the telescope both in its erect and reverse position—the clear length of suspension being about 32 inches.

3. *Sunday, 18th October.*—The detorsion bar was found just grazing against one of the side pillars due partly to want of exact balancing of the magnet and partly to the copper pillars of the instrument being not truly vertical. As the latter were fixed and not disturbed for years, it was deemed advisable not to touch them. The bar was carefully balanced again and it was seen that it swung clear of the pillars. As it appeared doubtful if the focal distance of the lens on the detorsion bar was the same as that given in the printed volumes for lens of the bar magnet, the detorsion bar was removed and the focal distance ascertained by 3 independent methods. The mean was found to be 11·9 inches, which was adopted, and the lens and scale adjusted to that distance, and the bar being carefully balanced again it was replaced and allowed to hang over night.

Monday, 19th October.—The bar was oscillating, but it could be roughly made out that the average torsion was about 60°. This was put right by turning the torsion head, the vernier B of which now read 121°15′. Attempts were made to read the scale, but as the oscillations were great, they were unsucessful. To see whether any large torsion existed or not, the small magnet was put in, but in the operation the stirrup bar slipped from the hand. If was not easy to tell whether the skein had acquired any torsion, and therefore the bar was again placed (without the magnet) and the instrument closed for the night.

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* I am subsequently informed that the manufacture of a fibre to carry the weight of such a large magnet and carrier was impossible.

Tuesday, 20th October.—The slipping of the bar would give the skein a torsion of 180° or its multiple, if the torsion was completely removed beforehand, but this morning the bar pointed to about 150°. This was corrected by turning the bar through 180° and correcting for about 30° by the torsion screw; the vernier B was set to read 90°. The small magnet was now put in the detorsion bar. Reading registered 33·03 corresponding to 19·73 reading of the magnetograph. On reversing the bar the reading was 10·48, when the magnetograph read 19·60. Thus the middle of the scale appeared to be $33{\cdot}03+10{\cdot}48=\frac{43{\cdot}51}{2}=21{\cdot}75$ instead of as it should be about 28. By proper reduction assuming that the old constants held good, it was seen that a large reduction of the torsion head angle was necessary, *but no correction was made.* The magnet was removed and the detorsion bar was allowed to hang over night.

Wednesday, 21st October.—At 8 hours this morning the bar was pointing 45° East of North. This was duly corrected and the torsion vernier B read 45°. By careful timing, by means of a chronometer, of the oscillations to and fro as the patch of light passed the field of view, it was seen that the torsion was now reduced to within manageable limits.

4. *Thursday, 22nd October.*—The bar was oscillating through a very small arc and its position was found to be very near the astronomical meridian as presumed the previous day. Now several trials by small changes in the torsion angle were carefully made to get the time of passage of the middle division of the scale as it passed from the right to the left and from the left to the right, as equal as possible. Every precaution was taken to prevent the amplitudes of oscillations becoming greater. When after several trials the vernier reading was put to 39°, a series of sets were taken, all of which more or less gave the same interval as the following set on each side of the middle division :—

h.	m.	s.		Interval of passage. m.	s.
5	24	57	Increasing scale reading ...		
	29	34	Decreasing scale reading ...	4	37
	33	57	Increasing scale reading ...	4	23

This gave a difference in time of passage equal to 14 seconds, which taking into consideration the velocity of the middle division (the maximum velocity) as it passed the telescope wire, suggested a correction of about a division and a half—that is, the middle division instead of being about 25, appeared to be 23·5. The bar was reversed and the instrument closed for the night.

Friday, 23rd October.—The readings this morning were as follows 25·0, 15·7, 24·8 } 20·3.

The exact reading of the torsion vernier was 39° 3′.

The bar was now put again in the erect position and left over night.

5. *Saturday, 24th October.*—An attempt to get a reading failed, the scale being just out of sight on the right (East), the outer frame of the glass scale blocking the light. This showed that the skein had not yet acquired a permanent equilibrium. A torsion of about 1° was given, increasing the vernier reading from 39° 3′ to 40° 2′ and the instrument closed for the night.

Sunday, 25th October.—The readings at about noon were 33·1, 38·1, 31·9 } 35·55.

Monday, 26th October.—The readings at $10^h\ 30^m$ were 29·9, 35·0, 29·4 } 32·3

at 11^h were 37·7, 34·0, 38·4 } 36·0

Tuesday, 27th October.—The readings at $10^h\ 45^m$ were 35·50, 41·50, 36·60 } 38·77

Wednesday, 28th October.—The readings at $10^h\ 45^m$ were 42·10, 35·80, 41·70 } 38·85.

The irregularity in the reading gave some trouble, but they showed that the limit within which the torsion of a bunch of silk fibres was irregular and could not be relied upon, had been reached. The keeping of the bar in the same position for so many days with a variation of about 7 divisions of the scale showed that the torsion was certainly within 2°, possibly within 1°. The variation in the readings up to the 27th October showed also that the skein had not acquired a permanent set and the zero was shifting con-

tinuously. The readings of 27th and 28th October, however, showed some tendency to stable conditions, and therefore 38·8 was adopted as the correct reading for the erect position of the bar. The reading 20·3 taken on the 23rd October with the reverse position of the bar, could not be accepted as a correct reverse reading, because the vernier reading of the torsion circle was different (by 1°), but it was adopted with the following correction. For 20·3 the torsion vernier read 39° 3′, and as the erect reading 38·8 corresponded to the torsion reading 40° 2′, a correction of about one degree of torsion had to be applied to the former. Taking the known factor 6′·825 the value of each main division of the scale, and assuming that the law of Coulombs holds good for small variations of torsion of silk fibres, 59′ of torsion corresponds to 59′÷6′·825 = about 9 divisions of scale. Thus the scale reading 20·3 for 39°·3 torsion scale reading would correspond to 29·3 for 40°·2′. The zero or middle of scale therefore would be the mean of 29·3 and 38·8, the reverse and erect reading respectively $= \frac{69 \cdot 1}{2} = 34$ nearly. If the middle of the scale be assumed to be 25—though previous adjustments showed that it was about 28—we have to correct for 34—25=9 divisions of the scale, *i.e.*, 9×6′·8=61′=1° nearly. If, however, 28 is taken as the zero of scale, the error is reduced to 41′ only. The detorsion bar was now removed. The collimator scale being detached from the bar it was carefully replaced in its original position on the magnet. It must be noted here that the lens and the stirrup of the bar magnet was not disturbed at all. After proper adjustment, the bar magnet was put in and the instrument closed for the night.

Thursday, 29th October.—The readings of the Grubb's declinometer and the corresponding magnetograph readings were as follows :—

h.	m.	Grubb's	Magnetograph.
16	12	33·00	19·60
22	12	32·98	19·58

The average reading of Grubb's 32·99 corresponding to 19·59 of the magnetograph when converted into arc by the old formula, agreed to within 2′ of each other.

6. *Friday, 30th October.*—At 6^h 12^m this morning the readings 33·00 and 19·51 of Grubb's and of magnetograph respectively though apparently showing a closer agreement between the two instruments than yesterday's, revealed the fact that as yet the zero was shifting rather abnormally.

Preliminary sets were taken for the determination of zero of scale, one in the morning and one in the evening.

TABLE I *a*.

30th October 1896.		Collimator Scale.				Mean of erect and inverted positions corrected for Declination.	Scale reading Declination Magnetograph.
		Erect position.	Mean.	Inverted position.	Mean.		
h.	m.						
		32·68					
11	21	32·83	32·755			28·063	19·40
		32·68					
				23·23			
11	55			23·49	23·360	28·130	19·41
				23·23			
		32·80					
12	22	33·12	32·960			28·340	19·46
		32·80					
				23·42			
13	16			23·90	23·660	28·220	19·51
				23·42			
		32·58					
13	44	32·98	32·780			28·268	19·51
		32·58					
				23·52			
14	9			23·92	23·720	28·222	19·54
				23·52			
		32·60					
14	35	32·92	32·760			28·147	19·57
		32·60					
				23·29			
14	57			23·73	23·510	28·090	19·59
				23·29			
		32·50					
15	29	32·84	32·670				19·59
		32·50					
					Mean=	28·185	19·51

TABLE I *b*.

30th October 1896.	Collimator Scale.				Mean of erect and inverted positions corrected for Declination.	Scale reading Declination Magnetograph.
	Erect position.	Mean.	Inverted position.	Mean.		
h. m.						
	32·80					
21 0 ...	32·86	32·830			28·122	19·64
	32·80					
			23·18			
21 42 ...			23·60	23·390	28·085	19·66
			23·18			
	32·68					
21 55 ...	32·88	32·780			27·902	19·64
	32·68					
			22·80			
22 18 ...			23·20	23·000	28·100	19·66
			22·80			
	33·10					
22 32 ...	33·30	33·200			28·122	19·66
	33·10					
			23·00			
22 48 ...			23·09	23·045	28·127	19·66
			23·00			
	33·34					
22 58 ...	33·08	33·210			28·100	19·66
	33·34					
			22·80			
23 13 ...			23·18	22·990	28·104	19·66
			22·80			
	33·12					
23 28 ...	33·34	33·230				19·67
	33·12					
				Mean=	28·083	19·66

At every inversion of the magnet the scale was not immediately visible, and it was found that the south end was a shade too low due to a want of exact balance of the bar magnet; but with gentle manipulation it was found possible to bring the scale in field of view (this was corrected subsequently).

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7. *Monday the 2nd November.*—Preliminary set for torsion coefficient was taken today.

TABLE II.

Time.	Torsion circle reading	Difference of torsion.	Grubb's scale reading.	Mean.	Difference of scale reading.	Difference corrected for Declination and calculated for 90°.	Scale reading, Declination Magnetograph
h. m.	° ′	° ′ ″					
			33·21				
20 18 ...	40 3		33·32	33·262			19·59
			33·21				
		29 55			0·693	2·085	
			33·80				
„ 43 ...	69 58		34·11	33·955			19·59
			33·80				
		29 50			0·665	2·006	
			33·21				
21 0 ...	40 8		33·37	33·290			19·59
			33·21				
		30 7			0·640	1·913	
			32·49				
„ 17 ...	10 1		32·81	32·650			19·59
			32·49				
		30 1			0·650	1·949	
			33·38				
„ 34 ...	40 2		33·22	33·300			19·59
			33·38				
		89 58			1·960	1·961	
			35·22				
„ 51 ...	130 0		35·30	35·260			19·59
			35·22				
		89 55			1·995	2·009	
			33·10				
22 12 ...	40 5		33·43	33·265			19·60
			33·10				
		90 6			1·755	1·753	
			31·42				
„ 32 ...	309 59		31·60	31·510			19·60
			31·42				
		90 10			1·860	1·857	
			33·52				
„ 55 ...	40 9		33·22	33·370			19·60
			33·52				

Mean Torsion for 90° = 1·942.

TABLE III.

Time.	Torsion circle reading.	Difference of torsion.	Grubb's scale reading.	Mean.	Difference of scale reading.	Declination Magneto-graph.
h. m.	° ′					
			33·22			
19 15	37 55		33·40	33·31		19·58
			33·22			
		134′			0·05	
			33·29			
19 25	40 9		33·43	33·36		19·58
			33·29			
		113′			0·06	
			33·30			
19 32	42 2		33·54	33·42		19·58
			33·30			

A torsion of 113′, it appears from the above table, gives a displacement of ·06 division when a greater torsion of 134′ on the other side gives only that of ·05 division,— that is less.

8. *Tuesday 3rd November.*—Effect of two degrees of torsion on each side was tried several times to see whether the readings were equally or unequally affected on both sides. The former would apparently hold true if there was no torsion and assuming that the silk skein obeyed the laws of torsion perfectly. If, however, any small torsion did exist, the addition of another small and about equal force of torsion would make the arcs on each side unequal, as on one side the force would have an additive effect, while on the other side it would have a subtractive effect. The effect it must be admitted, however, is very small. The two arcs 134′ and 113′ instead of giving proportionate differences in Grubb's scale give a smaller difference for greater torsion and a greater difference for smaller torsion. This showed that the torsion was not wholly eliminated. This result by itself would have no significance whatever, as the laws for very small angles of torsion are irregular and the difference being very small the errors of observations themselves would considerably vitiate the result. But as the same result was detected systematically in all such similar and subsequent observations of torsion, the presumption that the angle 40° 2′ is a little too large becomes very strong. Coefficients of torsion were determined this day from two sets.

TABLE IV *a*.

Time.	Torsion circle reading.	Difference of torsion.	Grubb's scale reading.	Mean.	Difference of scale reading.	Difference corrected for Declination and calculated for 90°.	Scale reading, Declination Magnetograph.
h. m.	° ′	° ′					
			33·38				
21 7 ...	42 2		33·52	33·450			19·59
			33·38				
		90 4			1·905	1·903	
			35·39				
„ 20 ...	132 6		35·32	35·355			19·59
			35·39				
		90 6			2·005	2·003	
			33·27				
„ 34 ...	42 0		33·43	33·350			19·59
			33·27				
		90 3			1·760	1·747	
			31·40				
„ 51 ...	311 57		31·78	31·590			19·58
			31·40				
		90 14			1·825	1·820	
			33·28				
22 6 ...	42 11		33·55	33·415			19·58
			33·28				

Mean Torsion for 90° = 1·868.

TABLE IV *b*.

Time.	Torsion circle reading.	Difference of torsion.	Grubb's scale reading.	Mean.	Difference of scale reading.	Scale reading, declination magnetograph.
h. m.	° ′	° ′				
			33·28			
22 50	40 1		33·40	33·340		19·59
			33·28			
		90 1			1·760	
			31·46			
„ 58	310 0		31·70	31·580		19·59
			31·46			
		90 2			1·820	
			33·50			
23 8	40 2		33·30	33·400		19·59
			33·50			
		89 56			1·950	
			35·22			
„ 17	129 58		35·48	35·350		19·59
			35·22			
		90 4			1·995	
			33·49			
„ 29	39 54		33·23	33·355		19·59
			33·47			
	Mean ...	90 1			1·881	
			Mean torsion for 90° = 1·878.			

9. The first set gives 1·868 and the second 1·878, the mean result being 1·873. From this the torsion coefficient was found to be $1+\frac{1\cdot873\times 6\cdot825}{5400-1\cdot873}\times 6\cdot825 = 1\cdot00237$. As no reliable altazimuth instrument was available, this night, observations of stars were made to determine approximately the angular value of an unit of scale division of the declinometer scale. Exact time of passage of certain stars across the interval of the two wires of the transit telescope of the declinometer was accurately taken, from which after due correction being applied, the arc was calculated. This divided by the number of divisions of the collimator scale subtended by the wires gave the scale value.

TABLE V.—*Observations of stars by the transit instrument of Grubb's Declination Manetometer.*

Name and Declination of Star.	Wires.	Time by chronometer of passage of star.	Interval of passage from 1st to last wire.	Calculations.
		h. m. s.	s.	
θ Capricorni, 17° 38′ S ...	1st	5 20 10·0	31·0	$\frac{31\cdot0\times\cdot95301}{4\times1\cdot09} = 6''\cdot776$
	last	5 20 41·0		
β^2 Cephei, 70° 5′ N ...	1st	5 46 42·3	87·0	$\frac{87\cdot0\times\cdot34065}{4\times1\cdot09} = 6''\cdot798$
	last	5 48 9·3		
				Mean = 6″·787.

Friday, 6th November.—To test the torsion finally, and to see whether the zero was not shifting abnormally, the bar magnet was removed once more and the detorsion bar (without the small magnet) was put in. This time the glass scale of the bar magnet was not displaced, it being thought advisable not to disturb the bar magnet adjustment often. A glass bit was cut to fit the detorsion bar scale carrier, of which the glass scale was missing and a cross was etched upon the glass as near as possible in the middle. The detorsion bar now properly balanced with the improvised scale, was put in and the instrument was closed for the night.

Saturday, 7th November.—When the light, &c., is suitably adjusted, the field of view commands a little over two main divisions of the scale. The cross was not visible, but the extreme points of the lines forming the cross, were visible. From the length of the lines which do not cover more than a fifth of the whole length of the glass scale, the error was found to be within 6 main divisions—about 40′ of arc confirming the previous results. No inversion was attempted. The bar magnet was now finally put in, and a set for the determination of zero was commenced which had subsequently to be abandoned on account of strong disturbance in declination.

Monday, 9th November.—It was observed on the 7th November at the time of determination of the zero of scale that a want of exact balancing of the bar necessitated some manipulation before the scale could be observed through the telescope. As the adjustment required a very small movement of the slider—the north end being a shade too high, the lens was shifted nearer the stirrup by about the thickness of a line (·02 inch) which at once corrected the mischief. The scale when viewed through the telescope before and after alteration showed no apparent change in the sharpness of the image. This reduced the focal distance from 13·1 to 13·08. Another set was taken for zero of scale this day.

TABLE VI.

Time.	Collimator Scale.				Mean of erect and inverted position corrected for Declination.	Declination Magnetograph	Constant in the erect position of Grubb's scale.
	Erect position.	Mean.	Inverted position.	Mean.			
	1	2	3	4	5	6	7
d. h. m.							
	33·39						
9 21 0	33·41	33·400			28·163	19·59	68·68
	33·39						
			22·78				
21 24			23·00	22·890	28·134	19·62	
			22·78				
	33·48						
21 35	33·30	33·390			28·055	19·63	68·30
	33·48						
			22·70				
21 55			22·74	22·720	28·156	19·63	
			22·70				
	33·71						
22 10	33·45	33·580			28·159	19·62	69·67
	33·71						
			22·79				
22 30			22·62	22·702	28·129	19·65	
			22·78				
	33·39						
23 0	33·65	33·520			28·126	19·62	69·26
	33·39						
			22·59				
23 45			22·97	22·780	28·128	19·58	
			22·59				

Time.	Collimator Scale.				Mean of erect and inverted position corrected for Declination.	Declination Magnetograph.	Constant in the erect position of Grubb's scale.
	Erect position.	Mean.	Inverted position.	Mean.			
	1	2	3	4	5	6	7
d. h. m.							
	33·40						
10 0 6	33·60	33·500			28·145	19·60	69·29
	33·40						
			22·68				
0 20			22·90	22·790	28·131	19·60	
			22·68				
	33·43						
0 46	33·49	33·460			28·115	19·59	69·09
	33·43						
			22·64				
1 0			22·90	22·770	28·108	19·59	
			22·64				
	33·60						
1 30	33·34	33·470			28·169	19·61	69·00
	33·60						
			22·80				
2 0			22·96	22·880	28·186	19·60	
			22·80				
	33·30						
2 30	33·66	33·480				19·59	69·23
	33·30						
				Mean= ...	28·136	19·61	69·06

10. *Wednesday, 11th November.*—Final set for zero was taken this day.

Table VII.

Time.	Collimator Scale.				Mean of erect and inverted position corrected for Declination.	Scale reading, Declination Magnetograph.	Constant in the erect position of Grubb's scale.
	Erect position.	Mean.	Inverted position.	Mean.			
	1	2	3	4	5	6	7
h m.							
	33·32						
11 24	33·08	33·200			28·126	19·53	67·81
	33·32						
			22·98				
11 55			23·10	23·040	28·016	19·54	
			22·98				
	32·99						
12 15	33·09	33·040			28·062	19·58	66·31
	32·99						
			23·10				
12 37			23·19	23·145	28·161	19·53	
			23·10				
	33·29						
12 45	33·04	33·165			28·151	19·52	67·65
	33·29						
			23·26				
13 16			23·04	23·150	28·150	19·51	
			23·26				

Time.	Collimator Scale.				Mean of erect and inverted position corrected for Declination.	Scale reading, Declination Magnetograph.	Constant in the erect position of Grubb's scale.
	Erect position.	Mean.	Inverted position.	Mean.			
	1	2	3	4	5	6	7
h. m.							
13 26	33·11 33·19 33·11	33·150				19·51	67·63
14 37	33·20 33·26 33·20	33·230			28·161	19·54	67·93
14 47			23·09 23·00 23·09	23·045	28·057	19·58	
14 58	33·18 32·96 33·18	33·070			28·059	19·58	66·51
16 7			22·91 23·09 22·91	23·000	28·165	19·62	
16 16	33·43 33·23 33·43	33·330				19·62	67·97
				Mean=	28·111	19·55	67·40

11. The mean result of the sets given in Tables VI and VII was taken and $\frac{28{\cdot}136+28{\cdot}111}{2} = \frac{56{\cdot}24}{2}$ = 28·123 adopted tentatively as zero of scale. It will be noticed that the figures in column 7 of Tables VI and VII give a constant—difference of scale reading of each instrument into the unit of scale division, Grubb's reading into 6″·825 and Magnetograph reading into 8″·13—which should not alter if the zeros of the two instruments do not shift. The magnetograph zero is so constant that for the last few years it has showed no appreciable change, and of course it can be relied upon for the short period of a few days. The changes in the average of column 7 therefore show the fluctuation in the zero of Grubb's. In Table VI the average of that day of column 7 was 69·06, which compared with that of the same column of Table VII 67·40 shows the somewhat large change which had occurred in the suspension skein in 48 hours. This night another set of star observations was taken to check the result of the set of 3rd November.

Table VIII.—*Observations of stars by the transit instrument of Grubb's declination magnetometer.*

Name and declination of star.	Wires.	Time by chronometer of passage of star.	Interval of passage from 1st to last wire.	Calculations.		
		h. m. s.				
θ Capricorni 17° 38′ S	1st	4 47 20·0	s. 31·0	$\frac{31{\cdot}0 \times {\cdot}95301}{4 \times 1{\cdot}09}$	=	6″·776
	last	4 47 51·0				
β^2 Cephei 70° 5′ N	1st	5 13 53·2	s. 86·8	$\frac{86{\cdot}8 \times {\cdot}34065}{4 \times 1{\cdot}09}$	=	6″·782
	last	5 15 20·0				
				Mean	=	6″·779

Distance between first and last wire of the transit telescope by repeated trials was found to cover 1·09 divisions of collimator scale.

The mean result of 3rd and 11th November $\frac{6''\cdot787+6''\cdot779}{2}=6''\cdot783$.

12. *Tuesday, 17th November.*—The instrument was temporarily closed since the 12th, and the readings were carefully compared with those of the Magnetograph and on days of absolute observations with absolute readings. The observations of the Declinometer when reduced, systematically denoted higher declination. During the several trials for the determination of zero of scale it was noticed that the position taken up by the stirrup bar in the stirrup holes was by no means always the same. The readings differed by as many as four small divisions equal to about 3′ sometimes when the bar was taken out and replaced, though there was no change in the declination. The irregularity in the figures in column 7 at once shows the mischief. As the instrument has now been in use for over 50 years, this perhaps is due to unequal wearing away of the stirrup bar or of the Y apertures in which it rests, giving fresh positions of contact *every time the bar was removed and replaced.* On the 11th November, when the bar was finally replaced, it will be seen from Table VII that the erect reading of Grubb's was 33·33 corresponding to 19·62 of magnetograph, while the previous erect reading 33·07 corresponds to 19·58 of magnetograph. The same discrepancy is noticed in the 1st and 3rd readings in the same table. To keep a decided record of such a change, and that in a marked degree, at $11^h\ 50^m$ the bar magnet was slightly supported for a moment so as to relieve the pressure on the stirrup bar, and the latter was gently moved in its Y apertures, after which the magnet was allowed to hang again. This at once changed the reading from 33·29 to 32·91. The change in the declination during the short time of the experiment was *nil* as shown by the magnetograph, which read 19·46. It was then a question whether the former or the latter observation denoted the correct position of the bar, the change in the two readings being comparatively great. As the last readings, when reduced, showed a nearer agreement than the previous numbers, and especially as the instrument had shown a tendency to an increased reading, the above change was accepted as in the proper direction and the reading adopted. The constant this day was reduced to 66·4.

1st December.—The presumption about increased reading was justified and the constant this day was 68·36. As for many days it remained steady, it appeared that the shifting of the zero in one direction was gradually and steadily becoming less.

On the 15th December the constant was 68·46.

13. *18th December.*—The declination telescope was taken in hand. All parts were carefully cleaned, and the wires, which were very thick and therefore fatal to accurate observations, were replaced by fine ones. The collimation error was then carefully destroyed. The middle wire when directed to the permanent collimating mark both in the erect and reverse position of the telescope gave the same reading 499·3 of the azimuth screw. After the change of wires the following set of star observations was again taken to determine the value of an unit of scale division.

TABLE IX.—*Observations of Polaris by the transit instrument of Grubb's Declination Magnetometer after putting new wires in the telescope for determination of the value of an unit of scale division.*

Date and Declination.	Wires.	Time by Chronometer of passage of star,	Interval of passage from 1st to 5th wire.	Calculations.	Value of one division in arc.
		h. m. s.			
	1st	5 1 50·0	...	10′ 24′ 40″·5 sin = 9·2569876 cos D = 8·3351192	
5th January 1897 88° 45′ 37″·5				13′ 26″·4 sin = 7·5921068	
			m. s.		
	5th	5 43 28·7	41 38·7	$\frac{806\cdot4}{1\cdot979}=409''\cdot3=$	6″·822

Date and Declination.	Wires.	Time by Chronometer of passage of star.	Interval of passage from 1st to 5th wire.	Calculations.	Value of one division in arc.
		h. m. s.			
	5th*	4 59 51	...	10° 23′ 30″ sin = 9·2551790	
				cos D = 8·3351192	
6th January 1897				13′ 23″ sin = 7·5902982	
88° 45′ 37″·5			m. s.		
	1st	5 41 25	41 34	$\frac{803\cdot0}{1\cdot970}$ = 407″·6 =	6″·793
	1st	3 52 45·5	...	10° 23′ 45″ sin = 9·2563512	
				cos D = 8·3331199	
23rd January				13′ 21″·5 sin = 7·5894711	
88° 45′ 58″			m. s.		
	5th	4 34 20·5	41 35·0	$\frac{801\cdot5}{1\cdot970}$ = 406″·9 =	6″·782
	1st	3 48 28·75	...	10° 23′ 56″ sin = 9·2564774	
				cos D = 8·3331199	
24th January				13′ 21″·7 sin = 7·5895973	
88° 45′ 58			m. s.		
	5th	4 30 4·50	41 35·75	$\frac{801\cdot7}{1\cdot970}$ = 407″·0 =	6″·783
	1st	3 44 14·5	...	10° 24′ 15″ sin = 9·2566953	
				cos D = 8·3331199	
25th January				13′ 22″ sin = 7·5898152	
88° 45′ 58″			m. s.		
	5th	4 25 51·5	41 37·0	$\frac{802\cdot0}{1\cdot970}$ = 407″·1 =	6″·785
Distance between 1st and 5th wire by collimator scale divisions = 1·970 by repeated trials.					6·793

* This observation was made with telescope reversed.

This result when compared with the average result of 3rd and 11th November show a close agreement, and the mean of the two $\frac{6\cdot781+6\cdot793}{2}$ = 6·788 was adopted.

14. Subsequently a small transit theodolite was made available and the following table gives the result of the determination of the value of an unit of scale division by that instrument :—

TABLE X.

Distance of lens on magnet from object glass of the telescope.	Date of Experiment, 1897.	Azimuth Circle reading. Beginning.	Azimuth Circle reading. End.	Difference of azimuth circle reading in minutes of arc.	Grubb's Scale reading. Beginning.	Grubb's Scale reading. End.	Multiple of arc.	Difference of scale reading into multiple of arc.	Deduced value of a unit of scale in minutes of arc or Column 5 ÷ Column 9.	Weight of Determination by arc.	Mean value of a unit of scale.
1	2	3	4	5	6	7	8	9	10	11	12
		° ′ ″	° ′ ″	′				′			
About 270 inches.	January 16th ...	263 0 0	263 40 0	40·0	36·395	30·525	1	5·870			
	,, ,, ...	263 0 0	263 40 0	40·0	36·385	30·457	1	5·928			
	,, ,, ...	263 0 0	263 40 0	40·0	36·355	30·515	1	5·840			
	,, ,, ...	263 0 0	263 40 0	40·0	36·415	30·480	1	5·935			
	April 26th	70 0 0	70 23 40	23·67	33·500	30·000	1	3·500			
	,, ,, ...	70 0 0	70 23 50	23·83	40·000	36·500	1	3·500			
	,, ,, ...	340 0 0	340 23 50	23·83	40·000	36·500	1	3·500			
	May 25th	70 0 0	71 0 40	60·67	32·000	33·500	6	9·000			
	,, ,, ...	70 0 0	73 4 40	184·67	32·000	33·500	18	27·000			
		Mean		15·376				2·2604	6·802	1·000	
About 130 inches.	January 16th ...	82 30 0	80 30 0	120·0	22·380	40·090	1	17·710			
	,, ,, ...	82 30 0	80 30 0	120·0	22·400	40·107	1	17·707			
	,, ,, ...	82 30 0	80 30 0	120·0	22·392	40·122	1	17·730			
	,, ,, ...	82 30 0	80 30 0	120·0	22·295	39·970	1	17·675			
	April 25th	170 0 0	175 27 20	327·33	24·000	36·000	4	48·000			
	,, ,, ...	135 0 0	131 35 30	204·50	23·000	38·000	2	30·000			
	,, ,, ...	131 0 0	136 48 40	348·67	23·000	40·000	3	51·000			
		Mean.		104·654				15·3709	6·809	6·806	6·786
About 17 inches.	January 18th ...	140 0 0	237 0 0	180·0	24·000	40·645	1	26·645			
	,, ,, ...	137 0 0	134 0 0	180·0	15·030	41·485	1	26·455			
	,, ,, ...	134 0 0	131 0 0	180·0	13·002	39·650	1	26·648			
	,, ,, ...	131 0 0	128 0 0	180·0	16·992	43·635	1	26·643			
	,, ,, ...	128 0 0	125 0 0	180·0	15·492	42·017	1	26·525			
	,, ,, ...	125 0 0	122 0 0	180·0	15·482	42·135	1	26·653			
	January 19th ...	150 0 0	133 4 50	1015·17	10·000	40·000	5	150·000			
	,, ,, ...	133 4 50	150 1 50	1017·00	10·000	40·000	5	150·000			
		Mean.		194·511				28·7231	6·772	12·650	

The diurnal change of declination is generally *nil* between 21h and 24h and to obviate any possibility of error by the introduction of corrections, experiments were conducted on those days and hours alone when the change in declination was *nil*. No declination correction therefore has been applied. That the value 6·786 obtained by the theodolite is smaller by ·020 than that determined in 1866, is self-evident. If the scale were not placed exactly at the principal focus, the observed values would show either an ascending or descending series of figures. The result in the table though showing great discrepancy in the three determinations, must be considered satisfactory looking at the kind of instrument made available. And the differences appear to be due more to errors of observation than to the non-coincidence of the scale exactly with the principal focus. It must be noted that the positions of the lens and the stirrup of the bar magnet were not disturbed at all during the adjustment, and that the slider carrying the scale only, was removed for use on the detorsion bar. Before removal a fine mark was made on the bar and the scale slider was again replaced carefully by that mark. There was thus no probability of the slider being seriously deranged in position, and the positions of the lens, stirrup and scale must be identically the same as before, the two former being not disturbed at all during the adjustment. It must have been noticed that a displacement of so much as ·02 of an inch disturbed the equilibrium of the magnet as shown by the difficulty of observation in the preliminary observations every time the bar was taken out and put in. This was corrected, and if any error in that respect is existing, it must be very small indeed.

As the difference in the old value and the new will produce an error in absolute declination of less than 6 seconds, it seems preferable, even if the new value is correct, to continue to adopt the old determination for the sake of preserving the comparability of the past and future records.

15. The following are the constants of the Grubb's instrument from time to time which will show the shifting of the zero up to 8th April 1897 :—

3rd December 1896 ...	... 68·38	11th February 1897 ...	... 69·45
17th " " ...	... 68·55	25th " " ...	... 69·29
31st " " ...	... 68·61	11th March " ...	... 69·50
14th January 1897 ...	... 68·92	25th " " ...	... 69·55
28th " " ...	... 69·04	8th April " ...	... 69·57

There was a sudden and serious movement of the zero of scale due to the earthquake of 12th June. This showed that the disturbance must have so strained the silk skein as to derange the position of the fibres. The box was subsequently opened and the detorsion bar was once again placed and the torsion which was found to be about 6° was eliminated. The constant since then has continued to remain steady, in reference to which it must be noted that the Declination Magnetograph has been remarkably steady and for the last three years the change in zero has been noted to be negligibly small.

APPENDIX E.

FIFTY YEARS OF GRUBB'S DECLINOMETER AND THE DECLINATION AT BOMBAY.

The instrument, the observations of the last 50 years of which are discussed herein, is one of those instruments described in the Report of the Committee of Physics of the Royal Society (1840), and therefore a detail description is omitted except in such particulars as are exceptional to the instrument at Colába and given in Appendix D. For reasons already given, the instrument was dismounted in October 1896 for fresh adjustment. The instrument was first adjusted in 1845 and the continuity of the record between 1845 and 1896 was broken, as far as the instrumental adjustments were concerned, on the following three occasions, (1) in December 1850, (2) from December 1855 to January 1856, and (3) from July to November 1861. In other words, from 1846 to 1850 the observations depended upon the constants of the first adjustment, from 1851 to 1855 on those of the second adjustment, from 1856 to 1860 on those of the third adjustment, and November 1861 to August 1896 on the fourth adjustment. While each of the previous adjustments lasted for short periods, the last adjustment allowed the record to run continuously for a period of nearly 35 years, when circumstances alluded to in the description of the adjustment determined its re-adjustment and suggested the inquiry into the history of the instrument. Although a declinometer of this kind is principally a differential instrument, no provision was made in this Observatory till June 1867 to standardise the readings by Absolute observations. The absolute values as given by this differential instrument were derived from the usual formula $\delta = (f - z)\, c\, t$* up to 1867, and at best therefore they could be accepted as approximately correct. And yet the treatment of the observations adopted in the following discussion it is hoped will be such as to reveal the true nature of the history of this instrument sufficiently accurate to enable legitimate inferences to be drawn as to the reliability or otherwise of the absolute values so determined. The observations of this instrument are made by a transit telescope, 30″ long, with pivots 15″ apart fixed on an isolated pillar of masonry about 27 feet due south of the instrument. The roof of the Magnetic Observatory is specially constructed with a narrow opening at top provided with shutters, to allow of periodic observations of polaris to be made.

2. To ensure stability, the basement of the transit is firmly imbedded in masonry on a separate foundation. As the readings of the declinometer must be influenced by a change in the telescope, it will be as well to note here that on every occasion on which the record was interrupted, or found inadmissible, due to change in or displacement of adjustment of the transit telescope, proper corrections or interpolations have been duly allowed for.

3. Absolute observations of declination by a Kew Pattern Unifilar were commenced in June 1867 and have run concurrently with those derived from the differential instrument. In 1871 the declination magnetograph was added, and since then the declination at Colába has been determined by three independent methods. The history of Grubb's from 1868 to 1896 being on this account more easy to reproduce, is taken in hand first; and relying to a considerable extent upon the facts and results revealed therein, an attempt to build up the history of the past years has been made.

4. In the following discussion the scale readings have been directly operated upon. The first step that suggests itself as the easiest—though perhaps not the best—is the direct comparison of the readings of the Grubbs with the tabulated values of the magnetograph taken at the corresponding time of the Absolute determinations by the Kew Unifilar. As a preliminary rough comparison the average of the readings of the period 1871—1895 being taken in each instrument and in the Absolute determinations as the equivalent zeros, three series are obtained and given in Table I, columns (1), (7) and (9) by converting the original readings into arcs by the factors 6′·825 and 28′·72 and modified by convenient constants as shown in the table.

* Where δ represents the declination, f the scale reading, z the zero or true meridian reading, c the value of an unit of scale division of Grubb's scale, and t the torsion coefficient.

TABLE I.—*Rough preliminary comparison of the determinations of Declination, by (1) Grubb's Declination, (2) Declination Magnetograph and (3) Kew Unifilar Magnetometer.*

Year.	Annual mean of observed absolute declination.	Excesses of column 1 over its mean value.	Annual mean scale reading of Grubb's declination at times of absolute declination.	Excesses of column 3 over its mean value.	Annual mean tabulation of declination magnetograph at times of absolute declination.	Excesses of column 5 over its *mean* value.	Column 3 converted into arc *minus* 195° 31.″	Column 7 *minus* column 1.	138′ 31″ *minus* column 6 converted into arc.	Column 9 *minus* column 1.	Sum of columns 3 and 5 converted into arc *minus* 334′ 2″ or col. 7 — col. 9.
	1	2	3	4	5	6	7	8	9	10	11
	′ ″	′ ″			Inches.		′ ″	′ ″	′ ″	″	″
1871 ...	49 38	− 1 4	36·088	+ ·012	3·0821	+ ·0247	50 47	+69	50 0	+22	+47
1872 ...	51 34	+ 0 52	36·309	+ ·233	3·0228	− ·0346	52 18	+44	51 42	+ 8	+36
1873 ...	52 38	+ 1 56	36·429	+ ·353	2·9947	− ·0627	53 7	+29	52 31	− 7	+36
1874 ...	53 26	+ 2 44	36·569	+ ·493	2·9609	− ·0965	54 4	+38	53 29	+ 3	+35
1875 ...	54 26	+ 3 44	36·696	+ ·620	2·9357	− ·1217	54 56	+30	54 12	−14	+44
1876 ...	55 3	+ 4 21	36·772	+ ·696	2·8975	− ·1599	55 27	+24	55 18	+15	+ 9
1877 ...	55 28	+ 4 46	36·793	+ ·717	2·8721	− ·1853	55 36	+ 8	56 2	+34	−26
1878 ...	56 0	+ 5 18	36·838	+ ·762	2·8559	− ·2015	55 54	− 6	56 30	+30	−36
1879 ...	56 26	+ 5 44	36·867	+ ·791	2·8544	− ·2030	56 6	−20	56 32	+ 6	−26
1880 ...	56 21	+ 5 39	36·890	+ ·814	2·8452	− ·2122	56 15	− 6	56 48	+27	−33
1881 ...	55 55	+ 5 13	36·851	+ ·775	2·8713	− ·1861	55 59	+ 4	56 3	+ 8	− 4
1882 ...	55 55	+ 5 13	36·724	+ ·648	2·8662	− ·1912	55 7	−48	56 12	+17	−65
1883 ...	55 55	+ 5 13	36·825	+ ·749	2·8867	− ·1707	55 49	− 6	55 37	−18	+12
1884 ...	54 33	+ 3 51	36·664	+ ·588	2·9135	− ·1439	54 43	+10	54 50	+17	− 7
1885 ...	53 52	+ 3 10	36·478	+ ·402	2·9542	− ·1032	53 27	−25	53 40	−12	−13
1886 ...	52 34	+ 1 52	36·362	+ ·286	2·9893	− ·0681	52 39	+ 5	52 40	+ 6	− 1
1887 ...	51 13	+ 0 31	36·111	+ ·035	3·0509	− ·0065	50 56	−17	50 54	−19	+ 2
1888 ...	50 4	− 0 38	35·983	− ·093	3·0968	+ ·0394	50 4	0	49 35	−29	+29
1889 ...	48 13	− 2 29	35·697	− ·379	3·1521	+ ·0947	48 7	− 6	47 59	−14	+ 8
1890 ...	46 22	− 4 20	35·442	− ·634	3·2157	+ ·1583	46 22	0	46 10	−12	+12
1891 ...	44 26	− 6 16	35·155	− ·921	3·2870	+ ·2296	44 25	− 1	44 7	−19	+18
1892 ...	42 40	− 8 2	34·908	− 1·168	3·3398	+ ·2824	42 44	+ 4	42 36	− 4	+ 8
1893 ...	40 19	−10 23	34·518	− 1·558	3·4301	+ ·3727	40 4	−15	40 0	−19	+ 4
1894 ...	38 34	−12 8	34·187	− 1·889	3·4876	+ ·4302	37 49	−45	38 21	−13	−32
1895 ...	36 9	−14 33	33·740	− 2·336	3·5730	+ ·5156	34 46	−83	35 54	−15	−68
Mean ...	50 42		36·076		3·0574		50 42		50 42		
Sum of excesses without regard to signs ..		120 0		17·952		4·2947					
Sum of excesses without regard to the signs converted in arc ...		′ ″ 120 0		′ ″ 122 31		′ ″ 123 21					

5. The most important feautres revealed from an examination of column 11 are that the years 1882, 1895 show out boldly as faulty years. The determination of the year 1882 was known to have been affected by the industry of a tiny species of spiders which somehow gained access to the interior of the box of the magnetometer and threw lines across from the inner side of the enclosure on to the magnet. It will be seen later on how the spiders had found their way inside the box, years before the mischief was detected, and the readings more or less of several years seem to be so affected. But the instrument had been very carefully closed in the year 1883 and it was a matter of some surprise to find that the years 1894—1895 showed departures which specially for 1895 in magnitude were worse than the error of 1882. Examining the monthly means and then the daily means the mischief appears to have occurred on 1st April, the amount of movement noticed being equal in arc to nearly $\frac{3}{4}$ minute—a sudden shifting of zero which had no counterpart in the magnetograph readings. As no spider lines appeared to have caused the mischief this time, the state of the bunch of suspension skein at once revealed the cause. For when the instrument was dismounted in October 1896 out of a total of about 52 fibres forming the skein about 11 appeared to have been broken. It seemed therefore that the mischief began in 1894 by the breakage of a few fibres perhaps lower down in the skein and at such places as not to allow the broken fibres to separate from the bunch. The result of such a breakage would be a slight and sudden change in the scale reading, but such as not to attract any special notice immediately. After that the scale reading showed no sudden movement, but it appears to have showed a steady but slow movement ever after this, due to the skein adapting itself to the new conditions (*vide* Fig. III, Plate I) till in August 1896 another rupture, and this time of a greater number of fibres, appears to have taken place which causing a movement in the same direction as that of 1894 and of nearly $3\frac{1}{2}'$ attracted immediate attention. It may be, in passing, noted here that after a continued heavy downpour in July and August 1996, the rains suddenly ceased about the third week of August—a most exceptional feature in the weather—and this affecting the moisture in the atmosphere very probably was the immediate cause of the rupture in the few fibres which were previously weakened by friction against the cross piece through which the silk skein passed into the glass tube after leaving the head screw (*vide* adjustment, Appendix D). In fact the evidence of the few short stumps of fibres found at the top of the bunch was there to show where exactly the rupture of the fibres took place. But for this breakage of the fibres *at the top*, their consequent separation from the bunch and their interference with the free motion of the magnet the mischief would possibly have remained unnoticed. So much for the decidedly bad years of the period, and this will be amply substantiated further on.

6. Glancing, however, at Table I, figures in columns 8 and 10 give the *specific* errors of each instrument and they, therefore, cannot be accepted as actual errors. The zeros adopted for the period under discussion should fulfil the following conditions, *viz.* (1) in each series the departures on each side of the adopted zero should be equal, and (2) the arithmetical sum of the departures in the series must bear to each other the ratio of 1 to $\frac{1}{0\cdot825}$ and 1 to $\frac{1}{2\cdot872}$ dependent upon the experimentally determined and accepted values of an unit of scale division of the Grubb's and Magnetograph declinometers respectively. The first condition is fulfilled from the nature of the treatment adopted, but the second condition is defective, as it must always remain so unless the instruments were perfect. The differences, however, serve to show how far the instruments may be relied upon for precision. The arithmetical sum of the departures for the three series reduced to arc are 120′, 122′ 31″, and 123′ 21″ for that of Absolute, Grubb's and Magnetograph respectively. The range of Grubb's appears to be larger by 2′ 31″ when compared to the departures of Absolute determinations, while it is contracted by 50″ when compared to that of Magnetograph. The value of an unit of scale division had been carefully ascertained in 1866 and found to be 6′·825 and a similar determination made lately (*vide* paragraph 19, Appendix D) gave almost exactly the same value. In order to suit the new ranges the value must alter to 6′·684 in the first case and to 6′·871 in the second case which obviously cannot be. The irregularity appears, therefore, partly instrumental and partly due to some extraneous causes and must be explained.

7. In what has already been stated and what follows it is assumed that the Absolute determinations at this Observatory can be relied upon as correct with a probable error of ± 2″ in the yearly determinations. This of course refers to observational errors only. Reducing the absolute observations to a constant tabulation of the magnetograph, for two years in the beginning of the period, two in the middle and two at the end, the probable

errors of a single determination and of the annual means were by the method of least squares found to be ± 13″, ± 13″, ± 10″ ± 8″ ± 17,″ ± 9″ and ± 2″, ± 2″, ± 1″, ± 1″, ± 2″, ± 1″ for the years 1872, 1873, 1884, 1885, 1894, 1895, respectively. It can be also safely assumed that the instrumental error is almost *nil*, as it may be noted that a careful comparison of the Observatory standard with another No. 131 by Nalder Bros. belonging to the Elphinstone College showed that at least the two instruments gave almost identical results, the average difference in the determination being found to be about 14″ only. At first the College magnetometer systematically recorded higher declination by about 2′-30″. This was investigated and the College Unifilar was found to have had faulty window glasses through which an object when seen was refracted by about that amount. The glasses were, therefore, substituted by others which were free from these faults. As in reading the scale of the magnet only one glass—that between the magnet and the telescope—would affect the reading, while the combined effect of both glasses would influence the reading of the azimuth of an object, the glasses were tried separately and together before being fixed on to the box.

Comparison of Kew Unifilar No. 131 with the Observatory Standard Instrument.

TABLE A.—*Declination.*

Date 1897.	Time.	Instrument.	Declination.	Corresponding Magnetograph scale reading.	Reading of C corrected to corresponding scale reading of Magnetograph for O.	O—C or column 4 *minus* column 6.
1	2	3	4	5	6	7
	h. m.		° ′ ″		° ′ ″	″
4th November	11 38	O	0 31 20	19·23	0 31 9	+11
„ „ ...	14 32	C	0 32 27	19·39		
11th „ ...	11 37	O	0 30 33	19·16	0 30 23	+10
„ „ ...	12 48	C	0 30 52	19·22		
18th „ ...	11 44	O	0 30 54	19·16	0 30 38	+16
„ „ ...	14 32	C	0 31 2	19·21		
25th „ ...	11 42	O	0 30 49	19·22	0 31 8	−19
„ „ ...	12 40	C	0 31 3	19·21		
2nd December	11 57	O	0 31 45	19·25	0 31 27	+18
„ „ ...	14 44	C	0 31 32	19·26		
9th „ ...	11 50	O	0 31 21	19·23	0 30 57	+24
„ „ ...	13 0	C	0 30 47	19·21		
16th „ ...	11 48	O	0 32 14	19·35	0 31 38	+36
„ „ ...	14 31	C	0 30 54	19·26		
Mean ...						+14″

8. The place where absolute observations are made is the old Electrometer Tower about 21 feet high and whose horizontal distance from the Grubb's magnetometer in the same building is about 20 feet. It was long suspected that there was a difference in the declinations at the two places, and as for the subject of this inquiry the exact determination of that difference was necessary, advantage was taken of the opportunity when the magnet was removed from the Grubb's instrument to make absolute observations at the very place where the Grubb's declinometer was located. As this is inside the magnetometer building, and as the sun is not visible from inside except at the time of its meridian passage, through the shutters in the roof, the following device was resorted to and the observations were made by Kew Unifilar No. 131. This instrument was placed about 8 feet—the nearest manageable distance—on the south of the pillar of Grubbs and between it and the transit telescope of declinometer, roughly on the line of astronomical meridian. A collimator (meridian) mark was temporarily devised on a stand due south of the transit telescope and about 5 feet away from the instrument and it was duly adjusted by the transit. The transit telescope being then removed from its support, the collimator mark was found visible from the unifilar, and by gently shifting the latter to and fro a position was found at which the cross wires of the collimator could be seen through the unifilar telescope and the latter adjusted to that position. The

distance between the two was about 24 feet and this as a preliminary step brought the telescope roughly on the line of the astronomical meridian. For more delicate adjustment the following means were adopted. The transit telescope was replaced in its support and the eye-piece of the telescope was removed and a lamp was carefully placed behind the opening, precautions being taken to prevent any damage to the spider lines. This arrangement changed the transit into a collimator (meridian mark). Now the unifilar was very gently moved east or west till the 5 wires of the transit could be seen through the unifilar telescope exactly in the middle of the field of view. The eye-piece was now replaced on the transit and the eye-piece of the unifilar was now taken out and a lamp held behind. A sight was now taken through the transit telescope and the vertical wire of the unifilar telescope was made to coincide with the central wire of the transit by either slightly shifting the unifilar or by turning the circle of the unifilar as was found expedient, at the same time adjusting the unifilar for level. These steps were alternately repeated till finally either when the transist was used as a telescope and the unifilar telescope as a collimator, or the latter as a telescope and the former as a collimator, the coincidence of the centre wires of the two instruments was perfect. The circle reading of the unifilar in this position was taken as denoting the true astronomical meridian reading. The adjustment was troublesome and obviously required great care and precision. The result of six such determinations shown in Table B makesout the average declination at that place about 3′-47″ higher than at the Electrometer Tower.

TABLE B.

Date 1897.	Declination by College Unifilar No. 131 taken near the enclosure of Grubb's Declinometer.	Corresponding magnetograph scale reading.	Date 1897.	Weekly observations of declination by Observatory standard at Electrometer Tower.	Corresponding magnetograph scale reading.	Average of column 5 converted to average of scale reading in column 3.	Average of column 2 *minus* average of column 7 or difference in declination at Electrometer Tower and near Grubb's instrument.
1	2	3	4	5	6	7	8
	° ′ ″			° ′ ″		° ′ ″	′ ″
14 October	0 36 41	19·41	7 October ...	0 29 21	19·01		
15 „ ...	0 35 35	19·29	14 „ ...	0 31 1	19·23		
16 „ ...	0 35 5	19·22	21 „ ...	0 30 44	19·18		
17 „ ...	0 35 52	19·26	29 „ ..	0 31 59	19·20		
17 „ ..	0 36 16	19·39					
18 „ ...	0 34 38	19·19					
Mean ...	0 35 41	19.29		0 30 46	19·15	0 31 54	3 47

The unifilar used in this experiment was not the standard instrument of the Observatory. But a comparison between the two instruments as already alluded to has shown that the determinations of the two instruments agree to within 14″ of each other. As this difference was considerably less than the probable error of the absolute determination, the difference 3′-47″ was assumed to be correct and no correction was applied.

9. *Fluctuation of Zero.*—After having determined the constant difference between the declination at the two places, the absolute series was used in the usual way to standardise the observation of Grubb's declinometer, and a series denoting the fluctuations of the zero of Grubbs was obtained (*vide* column 5, Table II).

After a detail examination of this series denoting the variations of the zero from 1868 to 1895, apart from the small irregularities which are usually associated with such instruments, it appeared that the series seemed to obey some general law depending upon some function of time. After trials the simple equation $z = a - b\sqrt{t}$ derived from $t = a z^2 + b z + c$ was obtained which seemed best to generally satisfy the conditions of the silk bunch, at least for the period under discussion, and it will be seen later on how far the equation is approximately representative of the actual facts of the period.

10. At first the whole period was, for convenience, divided into three divisional periods, the first and the last only being accepted for inquiry into the law, if any, under

investigation, the middle period being rejected. The reason of the omission (and it will be justified later on) is that the box of the declinometer, as already alluded to, though properly closed, allowed of the entrance and thriving of a small species of spider inside the enclosure. The working of the spiders must have for years remained unnoticed, as the errors introduced by the tiny webs were small, and until 1882 nothing was suspected, and only late in 1883, when the pull of the webs in one direction acquired noticeable dimensions, that an inquiry was instituted and the spiders discovered and removed, and the enclosure was finally and properly closed against the spiders in October 1883. The periods, therefore, from 1868 to 1877 and from 1884 to 1893 were provisionally accepted as correct.

11. *Trial Curve.*—After having decided upon this as a preliminary step, three points, the average of 5 years about the years 1874 and 1891 and the year 1886 were taken and the curve run through these points. The single year 1886 was specially selected as the third point of the curve, as of all determinations the result of 1886 showed the least error and agreed remarkably well with the result that year of Absolute determination and that of the Magnetograph, *vide* Table I, columns 8 and 11. Now it has been already noticed that there is a difference of about 3'·47″ in declination at the Electrometer Tower and the place where the Grubb's instrument is located. In November 1861 at the time of adjustment the zero of the scale was ascertained to be 28·273 (*vide* paragraph 13 for correct value), to which if the correction for the difference of 3'·47″ in declination be duly applied, it will give us the zero of scale of the series we are investigating, for the epoch November 1861. The test, therefore, of the suitability of the above formula to the conditions, if there be any regular law, must lie in the fact that the curve which passed through points between 1868 and 1895 should also pass through the original zero of 1861; and roughly it did, which stimulated further inquiry.

12. *Curve of fluctuation of Zero.*—An examination of the series with the preliminary curve showed that the errors of almost all individual years were small, but those of 1879 and 1882, 1894 and 1895, as suspected before, were serious, exceeding 30″ of arc. These four years were, therefore, omitted from the period 1868—1895, and the values of the constants $a=28{\cdot}9461$, $b=+{\cdot}06124$ in the formula $z=a-b\sqrt{t}$ were determined from the 24 equations so obtained by the method of least squares. The departures are given in column 7 and reduced to arc in column 11 of Table II and it will be seen at once that the agreement of the calculated curve with the actual points is remarkably close. The cobweb period the commencement of which it is not difficult to infer now, is boldly shown by negative errors. The point, however, of special notice is that the curve traced through these 24 points passes through the zero of November 1861, without any appreciable error, which enables us to presume that the formula may be accepted to represent approximately the conditions of the silk skein for the whole period from 1861 to 1895.

Table II.

Year.	Mean absolute observed Easterly Declination.	Corresponding mean scale reading of Grubb's Declination Magneto-meter.	Column 2 converted in Grubb's Declination Scale.	Mean inferred zero in Grubb's scale or column 3 *minus* column 4.	Calculated values of zero derived by the formula $z = a - b\sqrt{t}$.	Difference of observed zero *minus* calculated zero or column 5 *minus* column 6.	Annual mean scale reading of Grubb's Declination Magneto-meter.	Declination by calculated zero or column 8 *minus* column 6 multiplied by 6·625.	Mean absolute Declination reduced to the monthly mean reading of Grubb's Declination Magneto-meter.	Column 9 *minus* column 10.	Annual increments of column 9.	Annual increments of column 10.	Declination series from 1846 to 1895 at the place where Grubb's Declino-meter is located.	Absolute values calculated by formula for 1862 to 1895.	Column 14 *minus* column 15.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
								° ′	° ′	′	′	′	° ′	° ′	′
1846 ...													13 18		
1847 ...													14 1		
1848 ...													14 23		
1849 ...													14 40		
1850 ...													15 51		
1851 ...													16 47		
1852 ...													16 45		
1853 ...													18 8		
1854 ...													18 5		
1855 ...													19 20		
1856 ...													18 55		
1857 ...													19 17		
1858 ...													19 48		
1859 ...													21 25		
1860 ...													23 57		
1861 ...					†28·946								27 7		
1862 ...					·895		32·722	26 7					29 54	30 26	—0 32
1863 ...					·866		33·223	29 44			+3 37 +2 38		33 31	33 56	—0 25
1864 ...					·845		33·588	32 22			+3 47		36 9	37 14	—1 5
1865 ...					·828		34·125	36 9					39 56	40 22	—0 26
1866 ...					·813		34·707	40 14			+4 5 +2 38		44 1	43 16	+0 45
1867 ...					·800		35·082	42 52			+2 30		46 39	45 56	+0 43
1868 ...	43·950	35·273	6·440	28·833	·788	+·045	35·435	45 22	45 4	+18			49 9	48 25	+0 44
1869 ...	46·133	35·499	6·759	28·740	·776	—·036	35·697	47 14	47 29	—15	+1 52 +2 23	+2 25 +1 52	51 1	50 41	+0 20
1870 ...	47·783	35·808	7·001	28·802	·765	+·037	36·034	49 37	49 21	+16	+2 1	+1 52	53 24	52 42	+0 42
1871 ...	49·633	36·088	7·272	28·816	·755	+·061	36·321	51 38	51 13	+25			55 25	54 32	+0 53
1872 ...	51·567	36·809	7·556	28·753	·746	+·007	36·527	53 6	53 3	+3	+1 28 +0 46	+1 50 +0 57	56 53	56 8	+0 45
1873 ...	52·633	36·429	7·712	28·717	·737	—·020	36·629	53 52	54 0	—8			57 39	57 31	+0 8
1874 ...	53·433	36·569	7·829	28·740	·728	+·012	36·718	54 32	54 27	+5	+0 40	+0 27	58 19	58 41	—0 22
1875 ...	54·433	36·696	7·976	28·720	·719	+·001	36·830	55 21	55 21	0	+0 49 +0 36	+0 54 +0 37	59 8	59 38	—0 30
1876 ...	55·050	36·772	8·066	28 706	·711	—·005	36·928	55 57	55 58	—1			59 44	60 23	—0 39
1877 ...	55·467	36·793	8·127	28·666	·703	—·037	36·957	56 20	56 39	+19	+0 23	+0 41	60 7	60 55	—0 40
1878 ...	56·000	36·838	8·205	28·633	·696	—·063	36·999	56 40	57 6	—26	+0 20 +0 14	+0 27 +0 24	60 27	61 15	—0 48
1879 ...	56·433	36·867	8·269	28·598	·688	—·090	37·025	56 54	57 30	+36			60 41	61 23	—0 42
1880 ...	56·350	36·890	8·256	28·634	·681	—·047	37·007	56 49	57 9	—20	—0 5	—0 21	60 36	61 19	—0 43
1881 ...	55·917	36·851	8·193	28·658	·674	—·016	37·041	57 6	57 12	+6	+0 17	+0 3	60 53	61 4	—0 11
1882 ...	55·917	36·724	8·193	28·531	·667	—·136	36·859	55 55	56 50	—55	—1 11	—0 22	59 42	60 38	—0 56
1883 ...	55·917	36·825	8·193	28·632	·661	—·029	36·989	56 50	57 2	—12	+0 55	+0 12	60 37	60 1	+0 36
1884 ...	54·550	36·664	7·993	28·671	·654	+·017	36·826	55 46	55 39	+7	—1 4 —1 8	—1 23 —0 36	59 33	59 15	+0 18
1885 ...	53·867	36·478	7 893	28·585	·648	—·063	36·652	54 38	55 3	+25			58 25	58 18	+0 7
1886 ...	52·567	36·362	7·702	28·660	·642	+·018	36·494	53 35	53 28	+7	—1 3	—1 35	57 22	57 14	+0 8
1887 ...	51·217	36·111	7·504	28·607	·636	—·029	36·279	52 10	52 21	—11	—1 25 —0 40	—1 7 —0 59	55 57	55 59	—0 2
1888 ...	50·067	35·983	7·336	28 647	·630	+·017	36·175	51 30	51 22	+8			55 17	54 36	+0 41
1889 ...	48·217	35·697	7·065	28·632	·624	+·008	35·882	49 32	49 29	+3	—1 58	—1 53	53 19	53 5	+0 14
1890 ...	46·367	35·442	6·794	28·648	·618	+·030	35·617	47 46	47 34	+12	—1 46 —1 39	—1 55 —1 40	51 33	51 26	+0 7
1891 ...	44·433	35·155	6·510	28·645	·612	+·033	35·368	46 7	45 54	+13			49 54	49 40	+0 14
1892 ...	42·667	34·908	6 252	28·656	·607	+·049	35·110	44 23	44 2	+21	—1 44	—1 52	48 10	47 47	+0 23
1893 ...	40·317	34·518	5·907	28·611	·601	+·010	34·729	41 49	41 45	+4	—2 34 —2 37	—2 17 —2 9	45 36	45 47	—0 11
1894 ...	38·567	34·187	5·651	28·536	·596	—·060	34·339	39 12	39 36	—24	—2 42	—2 5	42 59	43 41	—0 42
1895 ...	36·150	33·740	5·297	28·443	·591	—·148	33·940	36 30	37 31	—61			40 17	41 29	—1 12
Mean ...								*51 28	51 24						

* Mean from 1868 to 1895 omitting errors of 1879, 1882 and 1895.
† For the epoch November 1861.

13. A word of explanation here is necessary. The printed volume of 1861 says that on 2nd November 1861, after proper adjustment the zero of scale was determined and was found to be 28·273. But on the 9th November the following note appears in the same volume :—"The fibres having now been left eight days to stretch, were carefully examined and found all to bear an equal strain, the brass bar was then suspended, and watched carefully to find what angle it made (when settled) with the true meridian. This experiment proved our conjecture to be correct, for the bar was slightly out of position, so we carefully brought it into the meridian in the usual manner. The arm B of the torsion circle showed 274° 30′."

The vernier B appears on the 2nd November to have stood at 267° 12′, and as on the 9th November the torsion circle was changed to 274° 30′, the previously determined zero of scale—28·273—will be altered by the application of a torsion of 7°, and from the coefficient of torsion 1·0028 determined then, the zero must have passed from 28·273 to about 28·445; to which if the difference in declination at two places converted into Grubb's scale be added, the zero will be 28·445+549=28·994. It is this zero we have to deal with, through which we find the curve sweeping with an error equal to 28·994—28·946=·048, or of 19 seconds in arc. But however carefully performed an adjustment may be, the fact remains that the elimination of torsion from a bunch of silk fibres is difficult and uncertain of attainment. Besides, if originally no torsion was allowed to remain, unless the skein had acquired that stable equilibrium (which requires that every one of the large number of fibres should be under uniform tension) *previous to the elimination of torsion*, some small amount of torsion is bound to be introduced subsequently. In the present instance it appears that the skein had not acquired that stability, and a small amount of torsion must have been introduced later on; and there is internal evidence to show that it must have existed and in the easterly direction so as to increase the normal declination. The torsional rigidity of the thick bunch therefore, gradually diminishing must have caused a decrease in the error due to torsion as years rolled on; and there is no reason why the elastic reaction of a thick silk bunch should not, under a long continued strain, decline in energy by the so-called fatigue of particles as in other materials under strain. If so, the zeros in column 6 of Table II, thrown into a curve (Figure IV, Plate 1) will represent the graph of the function denoting the law of fatigue of the particular bunch of silk fibres.

14. After the elimination of this error what remains must be due to irregularities from various causes, some of which can never be dissociated from the best of such instruments. The two series in columns 9 and 10 though agreeing in main features show small irregularities, which by the way may claim now to represent the actual errors. It may be noted, in passing, that omitting the errors of 1879, 1882 and 1895 the averages of the two series from 1868 to 1895 agree to within a second of each other—the means being 51′·23″ and 51′·24″ respectively for the Grubb's and Absolute determinations.

15. *Irregularities in secular growth.*—In several experiments performed upon Grubb's needle, the action of one ton of iron at a distance of 30 feet in the S. E. direction resulted in a deflection of about 60′ and, therefore, at a distance of 250 feet the action of 200 tons would produce, according to the law of inverse cube, an action of about 21″, while similar experiments performed on the unifilar needle give an average deflection of 15″ for 56 lbs. of iron at 5 feet distance. The action, therefore, of 200 tons at 250 feet distance on that needle would be less than 10″. It thus appears that any change in the mass of surrounding iron would result in producing a small but unequal difference in the determinations of declination at the two places. These experiments were especially conducted to see whether the adjoining gun battery, which is situated exactly in the south-east direction of Grubb's instrument and at a distance of about 250 feet, would, at all, have any appreciable effect on the magnetometers. That the action would be very small is obvious but the inequality of this action is the principal point we are concerned with. We are investigating small errors, so to say errors of the second order, and the secular growths as shown by the two instruments are thus bound to be disturbed even by the small action we have seen the magnets subject to.

16. The battery extends over a considerable portion of the adjoining ground, but the nearest part is made up of a battery of two 38-ton guns with their usual ammunition and accessories, and is exactly in the south-east direction—the line of maximum effect. If roughly the mass is put down to 200 tons (the exact mass cannot be ascertained), the action of that mass on any individual absolute observation is small when compared to the least error of observation. But as the present heavy guns were not there before 1888, though lighter guns were there and the whole has steadily grown into its present dimensions, the secular growth must be affected, and

that unequally at the two places—the growth indicated by Grubbs showing greater derangement. It is not by any means contended that the above is the principal cause of the irregularity to be noticed presently, but it may be sufficient here simply to indicate that of the several possible causes this may be one which ought to have some influence at least on the irregularity. Column 10 of the Table I and column 11 of Table II are graphically represented by Figures II and III, Plate I, showing the irregularities in the run of Grubb's and magnetograph curves. It will be seen that between 1871 and 1875 the run is parallel in the two curves. Several attempts were made in 1876 extending over a period of nearly two months before the receiver of the declination magnetograph was properly exhausted, and the parallelism is lost that year. Then from 1877 to 1880 they go more or less parallel again. The interruption from 1881 to 1883 is already known and will explain the actual opposite runs of two instruments. Then from 1884 to 1894 they run parallel except for the very small *opposite* run in 1888 which will be referred to later on. The slight derangement of Grubb's in 1894 and its subsequent effects, already alluded to, explains the sudden dropping of the Grubb's curve in 1895 and requires no further comments. It will be seen besides that the points of the graphs do not fall upon a horizontal straight line as they should if the growth of each instrument was coincident with that at the Electrometer Tower given by absolute determinations of the Kew Unifilar. Inferentially, therefore, it appears that while the growths by Grubbs and Magnetograph, both of which instruments have a comparatively stronger magnet than that of the Kew Unifilar and both of which are located nearer the ground than the place at the Electrometer Tower, are remarkably similar, that recorded by the Kew Unifilar at the electrometer is dissimilar. And this suggests an inquiry into a new channel. Suspected strongly as it is that the magnetic action at Colába involves a strong local factor, may not this local factor affect the secular growth, as registered by magnets of different strengths and at different altitudes from the ground, differently disturbing an otherwise general and uniform law? A rough trial survey of the compound of the Observatory has been made and from the results of Table III—results of more observations than one at each place—it will be seen that at several places the variation is considerable. While the greater portion of the compound is covered somewhat deep by the red sandy soil, at some places the basaltic traps crop up through the soil, and it is at these places that the variation is marked. (A detail investigation of this matter is in hand along with the project of the survey of Bombay and the adjoining districts.)

TABLE III.

Date.	Description of place.	Readings.	Corresponding mean Declination Magnetograph scale reading.	Results reduced to 19·12 scale reading of D. Magnetograph corresponding to the observation of 1st May 1897.	Remarks.
1	2	3	4	5	6
				′ ″	
1st May 1897.	On the pillar of Electrometer Tower.		19·12	31 3	By azimuth of Tárdeo chimney.
3rd do. ...		Back No. 1 ... 33 4 „ No. 2 ... 34 2 Front No. 1 ... 32 40 „ No. 2 ... 32 39			By azimuth of the Sun.
		Mean ... 33 6	19·37	31 4	
6th do. ...	Do. ...	Front No. 1 ... 34 27 „ No. 2 ... 34 29 Back No. 1 ... 34 45 „ No. 2 ... 34 55			Do.
		Mean ... 34 39	19·60	30 45	
				′ ″	
8th May 1897.	North end of Observatory compound by the side of observers' residences.	Front No. 1 ... 38 43 „ No. 2 ... 39 2 Back No. 1 ... 39 45 „ No. 2 ... 39 33			By azimuth of the the Sun.
		Mean ... 39 16	19·75	34 9	

Date.	Description of place.	Readings.	Corresponding mean Declination Magnetograph scale reading.	Results reduced to 19·12 scale reading of D. Magnetograph corresponding to the observation of 1st May 1897.	Remarks.
1	2	3	4	5	6
9th May 1897.	North end of Observatory compound by the side of observers' residences.	Front No. 1 ... 37 47 „ No. 2 ... 37 26 Back No. 1 ... 38 36 „ No. 2 ... 38 28 Mean ... 38 4	19·70	33 21	By azimuth of the Sun.
10th May 1897.	Near the well about 50 feet from the magnetometer office in the N. N. W. direction near which basaltic rocks crop out through the soil.	5 46	19·72	0 53	By azimuth of a mark corresponding to Tárdeo chimney.
Do.	Do.	Front No. 1 ... 5 33 „ No. 2 ... 5 30 Back No. 1 ... 6 6 „ No. 2 ... 5 36 Mean ... 5 41	19·72	0 48	By azimuth of the Sun.
12th May 1897.	Near the Lunatic Asylum, outside the compound on the west side about 500 yards away.	Front No. 1 ... 27 55 „ No. 2 ... 28 17 Back No. 1 ... 28 45 „ No. 2 ... 30 16 Mean ... 28 48	19·70	24 5	By azimuth of the Sun.
22nd Sept. 1897.	†On the north side of cook-room, near the compound wall of the Battery, about 160' from the magnetic office in S. E. direction.	Front No. 1 ... −19 51 Back No. 2 ... −19 21 Front No. 2 ... −19 29 Back No. 1 ... −19 38 Mean ... −19 35	19·50	*−22 40	By azimuth of the Sun.
25th do. ...	Do. ...	Front No. 1 ... −17 12 „ No. 2 ... −17 13 Back No. 1 ... −17 37 „ No. 2 ... −17 44 Mean ... −17 26	19·49	−20 26	Do.
1st Oct. 1897.	West side of magnetometer office about 5 feet from the wall.	Front No. 1 ... 33 41 Back No. 1 ... 33 39 Mean ... 33 40	19·41	31 19	By azimuth of the Sun.
2nd do. ...	Do. ...	Front No. 1 ... 33 12 Back No. 1 ... 34 1 Front No. 2 ... 32 42 Back No. 2 ... 32 8 Mean ... 33 1	19·40	30 44	Do.
3rd Oct. 1897.	On the pillar of ground floor of Electrometer Tower.	Front No. 1 ... 36 37 Back No. 1 ... 36 41 „ No. 2 ... 37 12 Front No. 2 ... 36 51 Mean ... 36 50	19·54	33 25	By azimuth of the Sun.
7th do. ...	Do. ...	33 45	19·01	34 39	By azimuth of the Light-house Tower in the E harbour.

* *Minus* means westerly declination.

† The great variation at this place presumably appears to be partly due to the action of the iron of the battery which according to the law of inverse cube would, assuming that the mass of iron is 200 tons, show a decrease in easterly declination by about 10 minutes—and partly to the local action of the ground.

17. That the secular growth should obey some definite law appears more plausible than that it should involve irregularities. From the situation of the Observatory, the declination element at Colába specially, is generally free from violent changes, and from its general run from 1861 to 1895—a period of 35 years—it appeared that the curve may be represented by a simple conic. The general form of equation of the 2nd degree was taken and the following constants of the formula $Ax^2+Bxy+Cy^2+Dx+Ey+1=0$ were determined from 32 equations by the method of least squares: $A=-\cdot003704239$, $B=-\cdot0006332303$, $C=+\cdot0002984279$, $D=+\cdot1542828$, $E=-\cdot07348405$. Column 15, Table II, gives the result, while column 14 gives the actual and column 16 gives the differences between the actual and calculated figures. Both these are curved in Figure I, Plate I, the thicker line representing the mathematical curve. It will be seen that the probable error of the 34 excesses (including the bad years 1882 and 1895 omitted in the calculations) amounts to ± 25″ only. The calculated curve of course represents with the above probable error, the condition between 1861 and 1895 and for that period *only* and is approximately applicable to the condition of that period alone—especially so as the examination of the yearly decrements of secular growth before 1861 shows that by some cause or another the growth is retarded, *i.e.*, the decrements become smaller suddenly and a point of inflection is given to the curve somewhere about that time. Before 1861 the Grubb's series, as already noted, consists of broken periods (1) from 1845 to 1850, (2) from 1851 to 1856 and (3) from 1856 to 1860, and as unfortunately no absolute observations are available to test the accuracy of the values, it is obviously a difficult task to say whether the retardation is merely a temporary check or otherwise, or whether the point of inflection is real or due to instrumental irregularities. The series of declination given in Appendix, Volume 34 of 1895, is, as explained in detail in that volume, made up of two independent series—from 1847 to 1867 recorded by Grubbs, showing declination at the place where this instrument is located, and obtained from the usual formula $\delta=(f-z).ct$; while the series from 1868 to 1895 is the absolute *observed* declination series by Kew Unifilar at the Electrometer Tower. The series given in Table II, column 14, and curved in Figure I, Plate I, is one continuous series giving the variation of declination at the place where the Grubb's instrument is located throughout the period 1846 to 1895.

18. The annual means of Grubbs as affected year to year by secular change have been discussed hitherto. The next step of inquiry runs in the direction of the monthly means to ascertain how far they are affected by any annual variation, whether due to magnetic or non-magnetic causes—especially that due to moisture. From the year 1877 the declination magnetograph has been under an exhausted receiver, and as during the period the instrument has shown no sudden or unusual movement of zero, this period of 19 years has been taken to ascertain the character and amount of the annual magnetic inequality. Table IV gives the inequality which, though small, shows the typical character of the curve. The absolute values of the same period treated in a similar manner give an inequality almost exactly of the same type, which leaves no doubt as to the reality of the phenomenon showing the two maxima and two minima with a range of about 18″. Table V is a difference table showing the excesses of the monthly means (reduced to arcs) of Grubb's over those of the Magnetograph. The series in this table is free from secular growth and from any annual inequality which may affect the two instruments *equally*. Assuming that they are affected equally by the annual magnetic inequality at the two places, the means of the monthly excesses would give the net annual variation in Grubbs due to other causes, especially including the non-magnetic cause—moisture—which while affecting the reading of that instrument, presumably has no influence on the readings of the magnetograph under an exhausted receiver. The inequality amounts to 44″ of arc, but with one maximum (in February) and one minimum in (August). During the monsoon months the readings of Grubbs persistently stand lower, while during the colder and drier months they stand higher than those of the magnetograph. And knowing, as we do now, that torsion existed in the suspension skein of Grubbs so as to increase the normal easterly declination, the effects of moist and dry weather on the torsion would be just as expected and as shown in the inequality.

19. The same inequality due to moisture and to other unknown causes, if any, is also shown by the difference Table No. VI of Grubbs and Absolute, with a variation of 31″, with one maximum in February and one minimum in September. The range is slightly different, but the character of the curve is unmistakeable. One deranging factor at least in this inequality is known, which may affect its range; the inequality involving the residual trace of the magnetic secular growth which is *not* equal at the Electrometer Tower, where absolute observations are made, and at the magnetometer room where the

Grubb's declinometer is located. If the monthly excesses of any year are examined, the more or less typical moisture curve is evidenced every year except for the years 1875, 1878, 1879, 1883 and 1888. Of these the first three belong to the cobweb period, the year 1883 being the year when the spider lines were found and destroyed.

TABLE IV.

Month.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Year.
	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″
Mean Declination ...	51 26	51 24	51 26	51 20	51 15	51 5	61 1	50 56	50 53	50 53	50 45	50 27	
Corrected for secular change	50 55	50 59	51 6	51 6	51 7	51 2	51 4	51 4	51 7	51 13	51 10	50 58	51 4
Annual variation ...	—0 9	—0 5	+0 2	+0 2	+0 3	—0 2	0 0	0 0	+0 3	+0 9	+0 6	—0 6	

TABLE V.—**Excesses of Grubb's over Declination Magnetograph.**

Monthly Means.

Year.	Month.												
	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Year.
	″	″	″	″	″	″	″	″	″	″	″	″	″
1871... ...	+125	+106	+105	+98	+ 44	— 31	— 21	— 14	— 15	—13	— 2	+14	+33
1872... ...	+43	+ 28	+ 3	+30	+ 44	+ 24	— 2	— 5	+ 15	+18	+36	+25	+22
1873... ...	+47	+ 37	+ 35	+16	+ 20	+ 11	+ 13	+ 20	+ 3	+13	+20	+32	+23
1874... ...	+42	+ 45	+ 43	+23	+ 15	+ 12	+ 7	— 1	+ 5	+ 6	+24	— 2	+18
1875... ...	+41	+ 49	+ 35	+45	+ 47	+ 32	+ 20	+ 24	— 2	+20	+17	+28	+30
1876... ...	+41	+ 25	+ 13	+12	+ 9	— 12	— 29	— 29	— 19	—29	—27	—12	— 5
1877... ...	—16	— 13	— 18	—20	— 32	— 47	— 55	— 60	— 61	—57	—49	—52	—40
1878... ...	—36	— 40	— 49	—41	— 71	— 84	— 50	— 59	— 59	—51	—36	—18	—50
1879... ...	—43	— 38	— 48	—53	— 56	— 47	— 29	— 27	— 8	—43	—47	—41	—40
1880... ...	—32	— 27	— 44	—30	— 69	— 68	— 60	— 53	— 56	—70	—40	—11	—47
1881... ...	+ 6	— 1	— 10	— 7	+ 11	— 10	— 50	— 30	— 26	—18	— 9	—70	—18
1882... ...	—64	— 64	— 67	—66	—101	—108	—114	—121	—100	—65	—37	—32	—78
1883... ...	—32	— 18	— 26	—36	— 45	— 7	— 21	+ 28	+ 17	+33	+34	+55	— 2
1884... ...	+ 9	+ 10	— 13	—25	— 31	— 36	— 40	— 49	— 37	—28	—14	— 4	—22
1885... ...	— 1	+ 1	— 15	—23	— 35	— 45	— 40	— 44	— 45	—41	—28	—11	—27
1886... ...	+ 7	+ 13	+ 6	—12	— 30	— 30	— 28	— 31	— 32	—30	—12	+ 5	—15
1887... ...	+ 5	+ 20	+ 9	— 6	— 14	— 22	— 26	— 28	— 34	—29	—14	+ 4	—12
1888... ...	— 2	— 2	— 8	+18	+ 33	+ 25	+ 15	+ 16	+ 16	+26	+32	+19	+16
1889... ...	+10	+ 19	+ 6	— 4	— 13	— 19	— 20	— 25	— 26	—19	+ 1	+16	— 6
1890... ...	+16	+ 15	+ 4	—10	— 14	— 15	— 11	— 5	— 8	— 2	+ 5	+15	1
1891... ...	+26	+ 34	+ 19	+ 9	— 11	— 2	— 8	— 17	— 10	—13	+ 3	+23	+ 4
1892... ...	+12	+ 24	0	—10	— 12	— 13	— 18	— 20	— 21	—27	— 2	+13	— 6
1893... ...	+25	+ 18	+ 9	—16	— 22	— 27	— 32	— 86	— 29	—20	— 6	+19	—10
1894... ...	+13	+ 11	— 4	—45	— 50	— 70	— 79	— 78	— 85	—78	—51	—48	—46
1895... ...	—51	— 56	— 75	—85	— 87	—101	—106	— 93	— 94	—98	—87	—62	—83
Mean excesses derived from 1877 to 1895 except 1879, 1883 and 1888.	—4	— 2	— 15	—24	—36	— 44	— 46	— 46	— 45	—40	—23	—13	—28
Variation ...	+24	+ 26	+ 13	+ 4	— 8	— 16	— 18	— 18	— 17	—12	+ 5	+15	...
Variation(1871 to 1876).	+36	+ 28	+ 19	+17	+10	— 14	— 22	— 21	— 22	—18	— 9	— 6	...

Table VI.—Excesses of Grubb's over Absolute Declination.

Monthly Means.

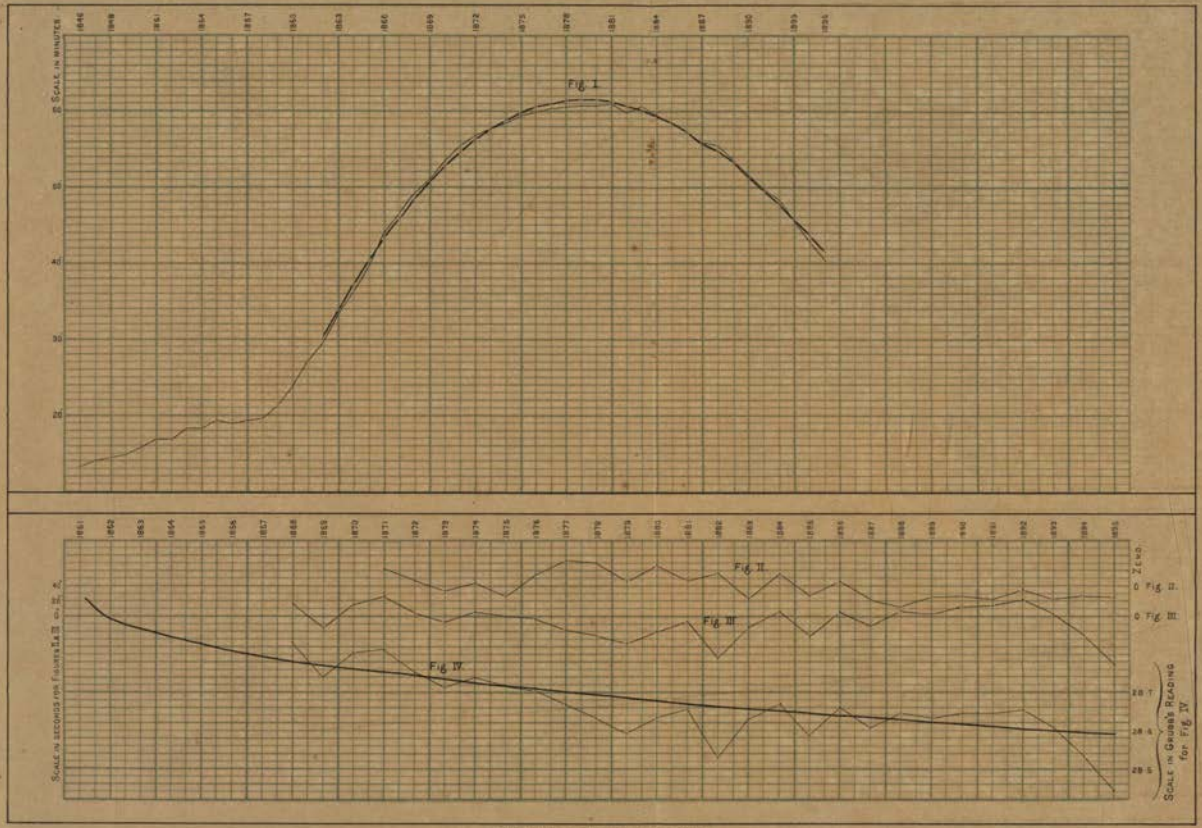
Year.	Months.												
	January.	February.	March.	April.	May.	June.	July	August.	September.	October.	November.	December.	Year.
	"	"	"	"	"	"	"	"	"	"	"	"	"
1870... ...	+ 42	+59	+61	+51	+39	+ 28	+ 18	+ 55	+ 28	+ 47	+ 77	+77	+ 47
1871... ...	+100	+82	+75	+58	+47	+ 44	+ 46	+ 32	+ 52	+ 29	+ 30	+34	+ 52
1872... ...	+ 45	+48	+31	+31	+35	+ 26	+ 25	+ 14	+ 11	+ 20	+ 19	+13	+ 26
1873... ...	+ 13	+17	+32	+17	— 3	+ 1	— 10	— 15	+ 8	+ 20	+ 24	+40	+ 12
1874... ...	+ 59	+50	+41	+30	+17	+ 1	+ 9	+ 12	+ 13	+ 7	+ 9	—27	+ 18
1875... ...	+ 5	+11	+13	+16	+ 4	+ 8	+ 10	+ 15	+ 20	+ 29	+ 18	+ 5	+ 13
1876... ...	+ 15	+14	+16	+25	+30	+ 27	+ 13	— 2	— 11	— 20	— 12	— 2	+ 8
1877... ...	— 14	+ 1	— 7	— 1	— 6	— 7	— 20	— 15	— 27	— 29	— 20	—34	— 13
1878... ...	— 33	—46	—35	—29	—34	— 48	— 13	+ 4	— 8	— 7	— 8	—24	— 28
1879... ...	— 51	—45	—46	—38	—47	— 43	— 44	— 27	— 27	— 18	— 24	—28	— 36
1880... ...	— 21	—11	— 2	—11	—28	— 37	— 33	— 37	— 28	— 25	— 27	— 8	— 22
1881... ...	+ 9	+ 4	+ 3	— 3	— 6	— 10	— 32	— 24	— 9	— 17	— 20	—46	— 13
1882... ...	— 47	—39	—49	—57	—70	— 79	— 96	— 87	— 87	— 66	— 49	—47	— 64
1883... ...	— 51	—51	—54	—64	—60	— 71	— 62	0	+ 8	+ 22	+ 53	+68	— 23
1884... ...	+ 30	+ 11	— 8	—16	—6	— 15	— 12	— 16	— 17	— 12	— 10	—10	— 7
1885... ...	— 13	—12	—19	—39	—57	— 70	— 68	— 63	— 65	— 39	— 40	—29	— 42
1886... ...	— 8	+ 11	+ 11	+ 13	+ 6	— 19	— 20	— 34	— 30	— 23	— 23	—18	— 12
1887... ...	— 25	—31	—29	—33	—25	— 44	— 4	— 39	— 43	— 30	— 38	—21	— 33
1888... ...	— 10	—33	—48	—47	—22	— 6	— 22	— 17	— 5	— 9	+ 5	+ 12	— 17
1889... ...	+ 3	+ 4	— 4	—22	—25	— 27	— 31	— 34	— 41	— 51	— 36	—15	— 23
1890... ...	— 9	—11	—19	—18	—21	— 14	— 22	— 29	— 20	— 13	— 13	—10	— 17
1891... ...	+ 3	— 7	— 7	— 7	—11	— 20	— 18	— 33	— 38	— 31	— 36	—14	— 18
1892... ...	— 7	— 1	— 1	0	+ 4	— 1	+ 7	— 14	— 31	— 42	— 48	—21	— 13
1893... ...	— 19	—15	—20	—36	—53	— 35	— 29	— 14	— 22	— 49	— 46	—40	— 31
1894... ...	— 35	—17	—17	—32	—43	— 61	— 58	— 75	—105	—109	— 98	—94	— 62
1895... ...	— 89	—88	—93	—97	—95	—111	—117	—100	—120	—106	—110	—87	—101
Mean excesses derived from 1870 to 1895 except 1875, 1878, 1879, 1883 and 1888.	+ 2	+ 3	0	— 7	—13	— 20	— 2	— 26	— 28	— 26	— 22	—17	— 15
Variation ...	+17	+18	+15	+ 8	+ 2	— 5	— 7	— 11	— 13	— 11	— 7	— 2	

20. No cause can be confidently advanced for the departure of the means from the usual run during the year 1888. That the fault is due to Grubb's instrument is evidenced from similar results observed in both the excess tables. No noticeable movement can be detected which can be differentiated from the usual movement, though between March and May the ordinary run ought to show a *fall* of the means by 21″, while the actual circumstances denote a *rise* of 41″ as shown in Table V. The same is observed in Table VI though less emphasised—the relative numbers being 13″ and 26″ respectively. Before 1877 the magnetograph was under a partially exhausted receiver, there being a constant and somewhat large leakage from year to year, and it was not till July 1876 that the receiver was free from leakage. The readings of that instrument, therefore, from 1871 to 1876 must have been affected in the same way as those of Grubb's by the moisture factor, but not to the same degree. If the moisture effect was the same at both the places in the underground room where the declination magnetograph is fixed, and overground where the Grubb's instrument is located, the differences of the two instruments ought to eliminate the factor altogether. If the effects are unequal, as they probably were in this case, the excesses would show the typical moisture curve but of smaller range. The range, however, as seen in the variation given in the bottom column of Table V (derived from six years' results from 1871 to 1876), is 58″. It, therefore, appears that any torsion that may have existed in the magnetograph silk skein presumably was in the opposite direction to that existing in Grubb's, that is, in the westerly direction, and the effect of moisture, therefore, would result in widening the range in the difference tables.

COLABA OBSERVATORY.

SECULAR VARIATION OF DECLINATION BY GRUBB'S DECLINOMETER.

PLATE I.



DRAWN & LITHO. GOVT PHOTOZINCO. OFFICE, POONA. 1888.

MAGNETICAL AND METEOROLOGICAL OBSERVATIONS

MADE AT THE

GOVERNMENT OBSERVATORY, BOMBAY,

1897.

WITH AN APPENDIX.

MAGNETICAL AND METEOROLOGICAL OBSERVATIONS

MADE AT THE

GOVERNMENT OBSERVATORY, BOMBAY,

1897,

UNDER THE DIRECTION OF

N. A. F. MOOS, Esq., B.Sc. (Edin.), F.R.S.E., &c.

WITH AN APPENDIX.

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TABLE OF CONTENTS.

PAGE.

INTRODUCTION TO THE METEOROLOGICAL AND MAGNETICAL OBSERVATIONS, 1897.

Thirty-sixth number of series ... ... i.
Local situation and geographical position, &c., of the Observatory ... ... id.
Directorship of the Observatory ... ... id.
PERSONAL ESTABLISHMENT AND ARRANGEMENTS, 1897 ... ... id.
Distribution of duties ... ... ii.
SYSTEM OF OBSERVATION ... ... iii.
Daily routine operations ... ... id.
Weekly routine observations ... ... iv.
Monthly observations ... ... id.
Quarterly, half-yearly and yearly observations... ... ... id.
General description of the Magnetical and Meteorological Instruments, their adjustments and the process of reduction ... ... id.
(*a*) METEOROLOGICAL INSTRUMENTS, 1897.
Standard Barometer, description of... ... ... id.
Error in setting the zero position of the scale, and change of method of observation ... ... v.
Corrections for error of verniers ... ... id.
Corrections applied to the observed readings ... ... vi.
Comparison with the Kew Standard Barometer ... ... id.
Barograph ... ... id.
Thermometers ... ... vii.
Standard Dry-bulb ... ... id.
Standard Wet-bulb ... ... id.
Photographic Dry-bulb and Wet-bulb ... ... id.
Ground Thermometers ... ... id.
Robinson-Beckley Anemograph, description of... ... ... viii.
Tabulation of anemograms ... ... ix.
Method of reduction ... ... id.
Dines Anemograph, description of... ... ... x.
Tabulation of anemograms ... ... xi.
Method of reduction ... ... id.
Rain Gauges ... ... id.
Newman's Rain Gauge ... ... id.
Photographic Rain Gauge ... ... xii.
New syphon of modified form ... ... id.
Constants for converting syphon discharges into inches of rainfall ... id.
Measurement and distribution of syphon discharges ... ... xiii.
Determination of scale of rainfall ordinates ... ... id.
(*b*) MAGNETICAL INSTRUMENTS, 1897 ... ... id.
Kew Unifilar Magnetometer ... ... id.
Kew Dip Circles ... ... xiv.
PROCESSES OF REDUCTION AND DESCRIPTION OF THE TABLES OF METEOROLOGICAL RESULTS, 1897.
Pressure of Vapour and additional capacity of the Air ... ... id.
Table I.—Regnault's values of the pressure of vapour at different temperatures ... xv.
Barometric pressure ... ... id.
Temperature of the Air, &c. ... ... id.

	Page.
Monthly and annual Range of Variation of Meteorological Elements	xvi.
Notes on Instrumental Changes and on all Irregularities or Departures from the routine of Observation or Reduction, 1897	id.
Robinson-Beckley Anemograph	id.
Dines Anemograph	id.
Method of interpolation in photographic tabulations	xvii.
Barograph	id.
Thermograph Dry-bulb...	id.
Thermograph Wet-bulb	id.
Self-registering Rain Gauge	xviii.

Tables of Results derived from the Continuous Registrations of Automatic Meteorological Instruments and from Meteorological Observations, 1897.

		1897. Table.	Page.
Daily Means of	Barometric Pressure	I	3
	Temperature of the Air	II	4
	Pressure of Vapour	III	5
	Additional Capacity of the Air	IV	6
	Individual observations in each Month of the Year, which showed the greatest and the least values of the following elements, *viz.*, Height of Barometer, corrected for Temperature; Temperature of Air; Pressure of Vapour; and Additional Capacity of Air	V	7
Daily.	Total Fall of Rain (in inches) as measured by F. Chambers's Self-registering Gauge, the funnel of which is 28 feet above the ground	VI	8
	Mean Velocities of the North or South and East or West Components of the Winds which blew on each Day of the Year	VII	9
	Mean Velocity of the Wind, in miles per hour, without regard to the direction from which it blew for each day of Bombay Civil Time; also the Mean Monthly Velocity, and its Variation from the Mean of the Year by Robinson Beckley Anemograph	VIII	10
	Mean Velocity of the Wind, in miles per hour, for each Day of Bombay Civil Time; also the Mean Monthly Velocity, and its variation from the Mean of the year by Dines Anemograph	VIII*a*	11
	Sums of the Velocities, and the Mean Velocities, in miles per hour, of the Winds which blew in each Month, from each of the sixteen Principal Directions; and also the number of observations which those sums comprise; the latter numbers indicating the Relative Frequency of the same Wind (*as to direction*) in the several months, and of different Winds during the same month	IX	12

Tables of Results derived from the Meteorological Observations made daily at 6, 10, 14, 16 and 22 hours, 1897.

		1897. Table.	Page.
	Monthly Mean Temperature of the Ground, and its Annual Variation, at the respective depths of 1, 9, 20, 60 and 132 inches below the surface	X	14
	Extent of Cloudy Sky—mean of estimations made at 6, 10, 14, 16 and 22 hours daily, the whole sky being reckoned as 10	XI	15
Daily.	Total Fall of Rain (in inches) as measured by Newman's Gauge, placed 4½ feet above the ground	XII	16
	Five-Day Means, 1897	XIII	17

Tables of Results of Absolute Magnetical Observations, 1897.

	1897.	
	Table.	Page.
Observations of Vibration and Deflection, taken with the Kew Unifilar Magnetometer (No. 23, by Elliot Brothers), for the determination of Absolute Horizontal Force	I	(3)
Observations of Absolute Declination	II	(6)
Observations of Inclination, taken with Barrow's Dip Circle, with Microscopes, No. 49 and two 3½-inch Needles	III	(7)
Supplementary Observations of Inclination, taken with Barrow's Dip Circle, with Microscopes, No. 49 and six 3½-inch Needles, and taken with new (Dover, Charlton's) Dip Circle with Microscopes, No. 110 and two 3½-inch Needles ...	III *a*	(10)

INTRODUCTION

TO THE

METEOROLOGICAL AND MAGNETICAL OBSERVATIONS,

1897.

The present volume—the thirty-sixth of its kind—extends the record of Magnetical and Meteorological Observations at the Government Observatory, Bombay, to a period of fifty-two years.

(2) *Local Situation of the Observatory, &c.*—The Observatory is located at the extreme end of a narrow and somewhat rising strip of land called Colába, running about 2 miles south-west from the Fort of Bombay, and separating the Harbour from Back Bay. The mean level of the Observatory compound is 32 feet above the mean level of the sea at Colába. Basaltic traps with their intertrappean beds, which constitute more or less the basis of formation of the whole surrounding coast, crop up at various places through the red sandy soil characteristic of the hills in the vicinity. The nearest elevated ground is Malabár Hill lying northwards at a distance of about 4 miles on the opposite side of the Bay, while that which subtends the largest vertical angle (but less than 1° 7′) as seen from this Observatory, is the southern hill of the island of Karanja situated east-south-east at a distance of about 8 miles across the Harbour. Since the average gradient from Bombay to the Western Ghâts is a little more than 1 in 100, the peculiar situation of the Observatory must influence but little the winds that reach Bombay from over the sea, which is the prevalent direction, and those blowing from landward from the Ghâts and beyond.

The exact geographical position of the Observatory is

Latitude 18° 53′ 45″ North.
Longitude 72° 48′ 56″ East.

The buildings concerned with the production of the observations recorded herein are, (1) the Astronomical Observatory and the Anemometer Tower, with a western wing, the greater part of which serves as a computing room, whilst the remainder is partitioned off for a photographic operating room; (2) the Magnetical Observatory with the adjoining Electrometer Tower; (3) the underground Magnetograph Room; and (4) the Thermograph Shed, enclosing the thermograph room; to which may be added the old thermometer shed.

(3) *Directorship of the Observatory.*—The observations of the year 1897 were taken under the direction of Mr. N. A. F. Moos, B.Sc. (Edin.), F.R.S.E.

(4) Personal establishment and arrangement, 1897—

MAGNETICAL AND METEOROLOGICAL DEPARTMENTS.

The establishment of Assistants in the Magnetical and Meteorological Departments of the Observatory consisted of the following persons :—

First Assistant	... Vinayak Narayan Nene—Fellow of the Bombay University.
Second Assistant	... Ganesh Sadashiv Joshi—Matriculated.
First Observer	... Shitaram Vithal Benderkar.
Second Observer	... Vithal Govind Ganekar—P. S. Certificate.
Third Observer	... Narayan Sakharam Kelkar—P. S. Certificate.
Computer	... Laxuman Balwant Chaphekar—School Final Examination.
Candidate	... Gopal Pandurang Subnis.

ASTRONOMICAL DEPARTMENT.

First Assistant	... Parsharam Laxuman Datar.
Second Assistant	... Damodar Vaman Sathaye—Matriculated.

From 1st September 1897 to the end of the year, Vithal Govind Ghanekar was on furlough, and his place was filled up by Gopal Pandurang Subnis.

Other vacancies caused by absence on leave of permanent employe's were filled on different occasions by Bhalchundra Krishna Fagre.

(5) The duties of the establishment are distributed in the following manner :—

The First Assistants are charged with the determination of values of instrumental constants and the more delicate observations requiring skill and long experience, and they generally control and superintend the whole of the work of their respective departments.

Upon the Second Assistant, Magnetical Department, devolve mostly the photographic operations. He is also responsible for all the photographic instruments which require constant and vigilant attention. The anemograph and meteorological work generally are attended to by the Second Assistant, Astronomical Department. The routine magnetical and meteorological observations are in general made by the observers, including the computer, who are made to take up the work by rotation. Amongst the duties of the observers are included the tabulation of all photograms, calculation and reduction of meteorological and magnetical elements, preparation of various meteorological and other returns, the calculation of daily averages and the writing out of the monthly abstracts. These latter consist of tables having the days of the month marked in numerical order in the first column and the hours of the day in order at the head of the columns, and there is one for each magnetical or meteorological element observed. In no case are the tabulations and reductions allowed to run into arrears unless very urgent special work is on hand. All observers attend the computing office when not actually engaged on observing duty. The Second Assistant, Astronomical Department, and Third Observer, Narayan Sakharam Kelkar, are entrusted with the absolute magnetic observations. Although every man is charged with duties which he is most competent to perform, precautions are taken to keep some of the observers fully instructed in the different operations to provide for the occasional absence of any member of the establishment. All computing operations are systematically performed by one computer and checked by a repetition of the operation by another. Residing accommodation is provided for all the members of the establishment on the Observatory premises. On Sundays and general holidays all observers are set free except 3, one being kept on observing duty, one in charge of photographic instruments and one in charge of astronomical duties. The following are the initials of the members of the staff, which the respective observers attach to the several observations made by them :—

Name.	Initial.
Vinayak Narayan Nene	V. N.
Ganesh Sadashiv Joshi	G. S. J.
Shitaram Vithal Bendarkar	S.
Vithal Govind Ghanekar	V. G. G.
Narayan Sakharam Kelkar	N.
Luxuman Balwant Chaphekar	L.
Parsharam Luxuman Datar	P.
Damodar Vaman Sathaye	D.
Bhalchundra Krishna Fagre	B. C.
Gopal Pandurang Subnis	G. P. S.

(6) System of Observation.

(*a*) *Daily routine operations.*

Magnetical and meteorological observations are taken every day including Sundays at the hours 6, 10, 14, 16 and 22: the day commencing at midnight, Bombay (Colába), is reckoned from 0 to 24. The time of observation of each element is fixed and the observations are registered with strict punctuality as follows:—

From 5^m to the hour to 2^m after the hour.	Extent and description of clouds, state of the weather, occasional phenomena, and direction of the wind.
At 2^m after the hour.	Thermograph standard thermometer, dry bulb.
	Do. do. wet bulb.
At 3 „ „ „	Newman's rain gauge (in wet season).
From 5 to 7 „ „ „	Thermometer in ground 1 inch deep.
	Do. do. 9 inches deep.
From 7 to 9 „ „ „	Newman's standard barometer No. 58 and attached thermometer.
	Do. do. No. 48 and do.
At 12 „ „ „	Grubb's declination magnetometer.
„ 14 „ „ „	Grubb's horizontal force magnetometer and its thermometer.
„ 16 „ „ „	Vertical force magnetograph No. 2 and its thermometer.
„ 17 „ „ „	Vertical force magnetograph No. 1 and its thermometer.
„ 18 „ „ „	Declination magnetograph.
„ 19 „ „ „	Horizontal force magnetograph and its thermometer.
„ 20 „ „ „	Thermometer attached to barograph.

The maximum and minimum thermometers in the thermometer shed, as also the solar radiation thermometer, are read twice daily at 8 and 16 hours.

Observations made once daily include readings of (1) the vacuum gauges of the magnetographs, (2) the maximum and minimum thermometers in magnetograph room, (3) the ground thermometers 20, 60 and 132 inches deep, and (4) nocturnal radiation thermometer. (1) and (2) are read at 10 hours—the maximum and minimum thermometers being reset immediately thereafter, (3) the ground thermometers are read at 14 hours, and (4) the nocturnal radiation thermometer read at 8 hours. Newman's rain gauge is read daily at midnight during the monsoon months, as are also the discharges of the syphon of the self-registering pluviograph once or oftener as required. The electric clock is duly regulated by comparison thrice daily with the sidereal clock. Government chronometers belonging to the Royal Indian Marine and Royal Navy in store at the Observatory and those received from merchant ships in harbour are wound

daily or as required, and comparisons with a correct clock are made with sufficient frequency to render the instruments always ready for issue at call with well-determined rates.

(*b*) *Weekly routine Observations.*

Double sets of observations of vibration and deflection are made with the unifilar magnetometer every Wednesday for the determination of absolute horizontal force. The same instrument is used every Thursday for the determination of declination. Observation for magnetic dip are made four times in a week—double sets on every Tuesday and Friday. Transit observations of stars for the determination of time and the errors and rate of the sidereal clock are made on Mondays, Wednesdays and Fridays in the dry months of the year. During the monsoon months no opportunity is lost for observing either the sun or the stars whenever visible. The adjustment of the Transit instrument is tested frequently by reference to the fixed collimator mark—the errors of collimation, level, &c., being determined from time to time or whenever the collimator showed a displacement of the telescope or any considerable discordances appeared in the clock errors derived from observations of stars of different north polar distances.

(*c*) *Monthly Observations.*

Regular deflection observations for the two vertical force magnetographs are made with deflector on North side only at 2·5 feet position about the middle of every month between 18^h and 24^h; the deflector used being tested on the Electrometer Tower the day following the former observations.

The magnets of Grubb's declination and Grubb's horizontal force magnetometers are vibrated through a large arc (but less than 1°) about the 20th of every month, and the variation of its accuracy of return to the original position is carefully recorded.

(*d*) *Quarterly, Half-yearly and Yearly Observations.*

Once every quarter the weekly intensity observations are supplemented by observation of the magnet with its inertia cylinder.

Once every six months the usual monthly deflection observations of vertical force magnetographs Nos. 1 and 2 are elaborated with deflector on both North and South sides.

Once every year the same series of observations are repeated for the vertical force and horizontal force magnetographs with deflector at various distances on each side of the magnet.

The time of vibration of Grubb's Declination and Horizontal Force Magnetometers are determined once a year.

(7) GENERAL DESCRIPTION OF THE MAGNETICAL AND METEOROLOGICAL INSTRUMENTS, THEIR ADJUSTMENTS AND THE PROCESS OF REDUCTION.

The following details show the special circumstances in connection with the condition, situation and adjustments of the various instruments, as also the habits of the observers and their routine processes of reduction, to enable the reader to form an independent judgment as to the reliableness of the observations and the degree of precision attained in the results.

(*a*) METEOROLOGICAL INSTRUMENTS, 1897.

Standard Barometer.—The barometer mounted on the eastern wall of the magnetical observatory a few feet from the north-east corner of the room is Newman No. 58 and is the same which has been in uninterrupted use since the establishment of the Observatory. Its tube is 0·53 inch in diameter. The

cistern, which is of glass, is 37 feet above the mean sea level at Colába. The brass scale is moveable and terminates at the lower end in a point of ivory which for every observation is set so as just to meet its reflected image as seen in the mercury. The scale is primarily divided to 0·05 inch and by means of vernier, 0·002 inch can be read off. To the moving vernier are attached two small brass plates with two lower edges before and behind the tube. The setting of the instrument consists in raising or lowering the vernier until the edges of the brass plates appear just to cut tangentially the convex surface of the mercury in the barometer tube, the line of sight being so regulated in height as to coincide with the edges. A thermometer with a cylindrical bulb dips into the cistern and was in use up to 1884, but in an investigation described in "Bombay Magnetical and Meteorological Observations, 1871 to 1878" it was discovered that the readings of the thermometer, as measuring the temperature of mercurial column, were considerably erroneous and the use of the thermometer was discontinued, and from the beginning of 1885 a thermometer by Murray and Heath, No. 2, divided to half degrees with its bulb immersed in a column of mercury held in a glass tube of nearly the same diameter as that of the barometer tube, was fixed to one side of the barometer, and readings of this thermometer have been used since 1885·0. The error of the attached thermometer varies by about a quarter of a degree within the annual range of the temperature of the barometer, and in adopting a mean error throughout, small pressure corrections of ± ·0003 have been disregarded.

The barometer was lifted down in 1866 and the mercury carefully run up to the top of the tube when it gave the sharp metallic click that is indicative of a good vacuum. It was replaced carefully in its position, the tube, &c., being kept in proper adjustment to verticality. The barometer is of the particular class, a description of which occurs at page 56 of the "Report of the Committee of Physics of the Royal Society, 1840" and therefore the scale of the barometer is laid off from the zero point from an authentic standard.

Since 1841, the year it was first mounted, there has been a gradual accumulation of scum on the surface of the mercury in the cistern, and the glass cistern became more and more opaque until the setting operation of the ivory zero point of the scale became a matter of difficulty and some uncertainty. For this reason the usual method adopted as described was changed on the 22nd May 1866. On that day the zero ivory point of the scale was set *once for all* and the setting screw removed, and suitable corrections for capacity were thenceforward applied to the readings. These were taken from the following formula :—

$$\text{Capacity correction} = \cdot 04321\ (h_0 - 29\cdot 943)$$

'h_0 represents the uncorrected reading)'

data for the construction of which will be found in "Bombay Magnetical and Meteorological Observations, 1865—70." Introduction, pp. x, xi.

As the fluctuation of the barometer reading from its mean value very rarely reaches ·4 inch, requiring a correction of ·017 inch, it seems very improbable that an error of so much as ·001 inch even occurs from any inaccuracy in the adopted values of the relative capacities of the tube and the cistern. Since the change was effected, the comparability of the observations for showing variations is on that account throughout much better secured.

The depression of mercury due to capillary action in a tube of ·53 inch diameter being small, no correction is applied on this account.

On 30th July 1875 it was discovered that the vernier scale of the barometer was short by ·002 inch. To correct the errors arising from this fault, instructions were issued to note the positions of coincidences at ·000 and ·050 of the vernier

scale with the scale of the barometer and also the non-coincidences at the above scales when the barometer reading was in exact half-tenths of an inch. It became then an easy matter to construct a table of corrections and to apply them for all positions of the vernier. These corrections have throughout been applied since then.

The barometer is read daily including Sundays at 7^m after the hours of observation—6, 10, 14, 16 and 22. Each reading is corrected by the application of the temperature correction—reducing the temperature of mercury column to 32° F. and that of the brass scale to 62° F. Another correction is applied to remove the error of discontinuity due to change of thermometer. The first correction is made by means of Table II of the Report of Committee of Physics of the Royal Society, the last by a constant reduction of the corrected pressure by ·002 inch. The considerations on which the last correction is based, are as follow:—(1) the tabulations of the barograph are known to exhibit correctly the diurnal variations of barometric pressure, free from any sensible influence of variations of the temperature of that instrument; (2) the mean of twenty-four hourly barograph tabulations on any day is taken to correspond to the mean of the same twenty-four hourly pressures observed with Newman's barometer No. 58 and corrected for the temperatures indicated by the old attached thermometer; (3) it does not follow that the mean of the tabulations for the five observation hours (6, 10, 14, 16 and 22) will then correspond exactly to the mean of the observed pressures for the same hours, because the old thermometer does not indicate precisely the actual variations of temperature of the mercurial column: in fact the latter mean pressure was, on the average of all the observation days of the year 1872, ·0008 inch in excess of the former mean pressure; (4) nevertheless the correspondence for the five observation hours was adopted as near enough to identity with the correspondence for the twenty-four hours, and the recorded mean pressures of the years 1873 to 1884 will thus be ·0008 inch in excess of those of the years before 1873; (5) the old attached thermometer and the thermometer No. 2 by Murray and Heath were read together at the five observation hours throughout the year 1883, and the average excess of the former reading over the latter was found to be 0°·62; (6) hence to make the pressures reduced for the readings of Murray and Heath No. 2 correspond to those reduced for the readings of the old thermometer the former pressures must be decreased by $\cdot0027 \times 0\cdot62 = \cdot0017$, or—as the pressures are read and calculated only to thousandths of an inch—by ·002 inch. Thus taking the period before 1873·0 as a standard period, the recorded annual mean pressures of the years 1873 to 1884 will be ·0008 inch too high, and those of 1885 and later years ·0005 inch [$= -\cdot0020 + \cdot0017 + \cdot0008$] too high.

Indirect comparisons of the barometer have been made with the Kew standard by means of two mountain barometers by Negretti and Zambra, numbered 705 and 711, when they were both found (in July 1876) to read ·011 inch higher than the Observatory standard. In England, however, they had been found to read ·007 and ·006 respectively higher than the Kew standard. Hence on an average the Observatory standard barometer read ·004 below the Kew standard. It happens that this is exactly the average amount by which the readings of Newman's barometer have been over reduced for temperature (*vide* Introduction to Bombay Magnetical and Meteorological Observations, 1871-78, paragraph 72).

Barograph.—The photographic barometer stands separate on two pillars in the magnetograph room. It was supplied through the Kew Committee of the British Association after being tested at the Kew Observatory, and is similar in construction to those adopted by the Meteorological Committee of the Royal Society for the seven observatories established by them in the United Kingdom in the year 1867. The barograph has been treated as an independent instrument in respect of the variation of pressure occurring in the course of a day, but only as an auxiliary to Newman's standard barometer, No. 58, in respect of

mean daily pressures. The excess of the mean of the five observations made daily with the latter instrument over the mean of the corresponding five barograph tabulations has been used as a correction to the mean of the twenty-four hourly tabulations for the same day, a new correction being calculated for each day. A detailed account of the instrument and its particulars and adjustment is given in the "Bombay Magnetical and Meteorological Observations, 1871 to 1878, page xvi to xlvi."

Standard Dry Bulb.—The thermometer is by Casella and marked No. 401: it is a mercurial thermometer, with a cylindrical bulb 3·7 inches long and about 0·37 inch in diameter. The stem is graduated and divided in degrees: the range is from 0° to 120°, measuring 12·36 inches; and the bulb is freely exposed to the air. It is placed in the cage of the thermograph shed about 5 inches from and similarly exposed as the thermometer which records photographically.

Standard Wet Bulb.—This is also a mercurial thermometer by Casella No. 402 and has a cylindrcial bulb 3·7 inches long and 0·37 inch in diameter. The thermometer is graduated on its stem and is divided to degrees with a range from − 10° to +120°, measuring 13·03 inches. The bulb is covered with muslin, and is kept moist by capillary action of a bundle of fine cotton threads immersed in a small vessel of water near the thermometer bulb, and passing loosely round the thermometer stem just over the bulb. The same vessel of water supplies the evaporating fluid to the photographic wet bulb placed about 3 inches distant.

The errors of the above standard thermometers have been carefully found and corrections duly applied. The errors were determined by a Kew standard (No. 368) thermometer in February and March 1875, at fourteen points ranging between 32° and 102°, and the readings were found to be within 0°·1 of the truth. On 20th December 1877, the errors of the freezing points were also tested, showing no noticeable change (*vide* paragraph 53, Table 10 of the Introduction to the Bombay Magnetical and Meteorological Observations, 1871 to 1878).

Photographic Dry Bulb and Wet Bulb.—The height of the bulbs of the thermometers of the thermograph above the ground is 10 feet. The cage is placed on one of the most exposed parts of the Observatory grounds and away from any building; it is, however, screened, as well as the thermograph room in which the recording apparatus is placed, by a roomy shed with a planked roof that is everywhere 2 feet above the roofs of the cage and room: the sides of the shed are of the louvre construction on an enlarged scale, with double sheets of zinc enclosing a thick layer of felt substituted for the wooden laths, and with a vertical distance from lath to lath of one foot: the lowermost two feet of the sides are guarded simply by horizontal iron rods: the roof of the shed is covered with thick felt and then with strong canvas, and the whole of the exterior—sides and roof—is painted or limewashed white.

The scales of these instruments in use now have been determined from a year's results of comparisons of the thermograph tabulations determined by provisional scales, with the readings of the standard thermometers—taken 5 times daily—the excesses of the tabulated values so obtained over the eye observations being duly corrected at different temperatures in the construction of the permanent scales.

Ground Thermometers.—Thermometers with their bulbs at the respective depths below the surface of the ground of 1, 9, 20, 60 and 132 inches are regularly observed, the two former five times a day and the three latter once a day at 14 hours. They are all by Newman, of London, and are divided on brass scales, and the value of one division, approximate range of part of scale

exposed above ground, and lengths of that part and of one average degree are shown below for each thermometer:—

Depth of Bulb.	Divided to	Approximate Range of exposed part of Scale.	Length of that Range.	Average length of 1°.
Inch.			Inches.	Inch.
1	1°	30° to 145°	8·19	·071
9	0°·2	70° to 115°	5·20	·116
20	1°	35° to 160°	6·73	·054
60	1°	35° to 160°	6·81	·054
132	1°	50° to 140°	6·44	·072

The 1-inch and 9-inch thermometers are on flat brass scale frames, which lie against wooden posts in the ground, and they have their bulbs in contact with the loose red earth which fills the holes in which they are placed; the 20-inch, 60-inch, and 132-inch thermometers have their lower parts enclosed in brass tubes with ends curving off to a point, and the upper parts are in wooden box frames, to which the brass scales are fixed. The reason why only one observation is made daily of the three deeper thermometers is, that it had been found by hourly observations in 1849, 1850 and 1851, that no appreciable diurnal variation of temperature reached the depth of 20 inches.

The errors of graduation of the ground thermometers are unknown.

Robinson-Beckley Anemograph.—From the establishment of the Observatory till December 1865 a rough pressure anemometer was in use. This was replaced by a small anemometer by Robinson which remained in use up to June 1867. From the beginning of the month of June 1867 was brought into use an anemograph of the kind designed by Robinson, with improvements by Robert Beckley, and it remains in action to this day. It was made by Mr. R. W. Munro, and was supplied through the Kew Committee of the British Association, after being tested at the Kew Observatory. In this instrument the arrangements for the registration both of movement and direction of the wind are mounted on one shaft, and the registrations are made on a single sheet of paper, which is changed daily. The essential part of the apparatus for measuring the movement is a vertical spindle, to which cross arms are attached at the top, carrying four hemispherical cups of copper. The cups are attached to their several arms, so that, looking from the central axis, their convex sides are seen turned to the right hand, and the wind, acting with greater effect upon the concave than on the convex sides of the cups, causes the system to rotate in a right-handed direction. It is the number of these rotations, 140 of which are reckoned to a mile of movement of the wind, that tells us how fast the wind has been blowing; and the number is reduced, by means of wheelwork, 7,000 times before reaching a small cylinder, carrying a brass spiral pencil that traces the movement on the registering paper; this latter is metallic paper of the kind used for pocket-books, and is wrapped round a brass cylinder, which is kept rotating by clockwork, and as the paper passes under the spiral pencil, which presses slightly upon it, the black movement trace is received upon it. The wind vane, which consists of a pair of windmill vanes with connecting spindle having an endless screw in the middle, and gearing into a fixed horizontal toothed wheel, is attached to a tube that surrounds the lower part of the vertical movement spindle; to the bottom of the tube is fixed a toothed wheel, which, in communication with other such wheels, conveys the motion of the vane *unchanged* to a small cylinder with spiral pencil, which traces the changes of direction on the register; and it is so arranged that the movement and direction are traced on parallel strips or bands of the same sheet of paper which is changed daily at 10 hours. The heavy parts of the instrument—the direction vane and appendages, and two long

brass tubes which connect the instrument proper with the recording apparatus—are supported on friction balls which run in grooves partially filled with oil, thus reducing the friction to a minimum. The instrument is erected on the old Time Ball Tower, at a height of 53 feet above the ground, and 95 feet above the mean sea level, over a platform 12 feet in diameter, which is designed to give ready access to the instrument, and to protect it from irregular currents of wind, glancing from the convex surface of the dome; and it is supported outside by a fixed cast-iron standard, to which is attached, at the top, the toothed wheel, into which the endless screw of the spindle connecting the windmill vanes gears. The centres of each pair of opposite hemispherical cups are four feet apart, and three and a half feet above the platform, and the diameter of the cups is nine inches. The diameter of the vanes is 15 inches, and the breadth of the fans four inches. The register form is printed in red, with lines dividing its length into hour spaces; and its breadth, on the movement side, into five spaces, each representing 10 miles of movement of the wind, and numbered from 0 to 50 miles; and on the direction side into spaces corresponding to 11¼ degrees on each side of the 16 principal directions N.N.E., N.E., &c.....N.N.W., N., which spaces are numbered consecutively 1, 2, &c.....15, 16.*

Tabulation of Anemograms.—Numerical tabulations have been made of the movement and direction of the wind during the interval between every two successive hours in the following manner:—the number of miles indicated at the point where the velocity trace cuts a horizontal hour-line being read for two successive hours, the excess of the latter over the former reading (adding 50 if the trace has passed over from left to right of the form) gives the movement for the interval; and the number of the space in which the direction trace lies during the interval is entered as representing the direction. The estimations of movement are made only to the nearest full mile. Should the direction trace not lie all in one space during the whole interval of an hour, then if the change of direction exceed 90° or eight points, the whole observation for that hourly interval is rejected; but if it lie within that limit, the direction is estimated—by an inspection of the movement and direction traces together—whence the aggregate flow of air was the greatest, and this direction is adopted for the full hour. On the average of the years 1871 to 1883, out of 8,754 hours during which the instrument was in action, 3 only had to be rejected because the direction of the wind varied more than eight points within the hour.

Method of reduction.—Hitherto we have had to speak of phenomena liable only to simple increase and decrease of value, and not subject to any change of quality. Such phenomena being properly and completely evaluated by simple numbers, we may apply to the numbers any arithmetical operations, such as averaging, and infer from the results of those operations corresponding properties of the phenomena. But we have now come to a phenomenon which requires two numbers to express it, one representing its amount and the other a varying quality; the first referring to the velocity, and the last to the direction of the wind. Here we may no longer apply arithmetical processes directly and indiscriminately to the observed numbers: but, the subject being one of motion, we must treat them according to the principles of the science of motion. These principles tell us that the motions may be equally well expressed by means of two varying numbers referring to two invariable qualities, as by a varying number referring to a varying quality; and they show us how to obtain either form of expression from the other. The invariable qualities chosen in the present case are the directions north and east, the actual wind blowing in each hour being resolved into north and east components, which may be regarded separately as the velocity of the wind in the invariable direction north

* A more detailed account of the Colába anemograph will be found in the "Bombay Magnetical and Meteorological Observations, 1865 to 1870," Appendix I., page 199.

or south, and the velocity of the wind in the invariable direction east or west. The resolutions are effected by means of the formulæ :—

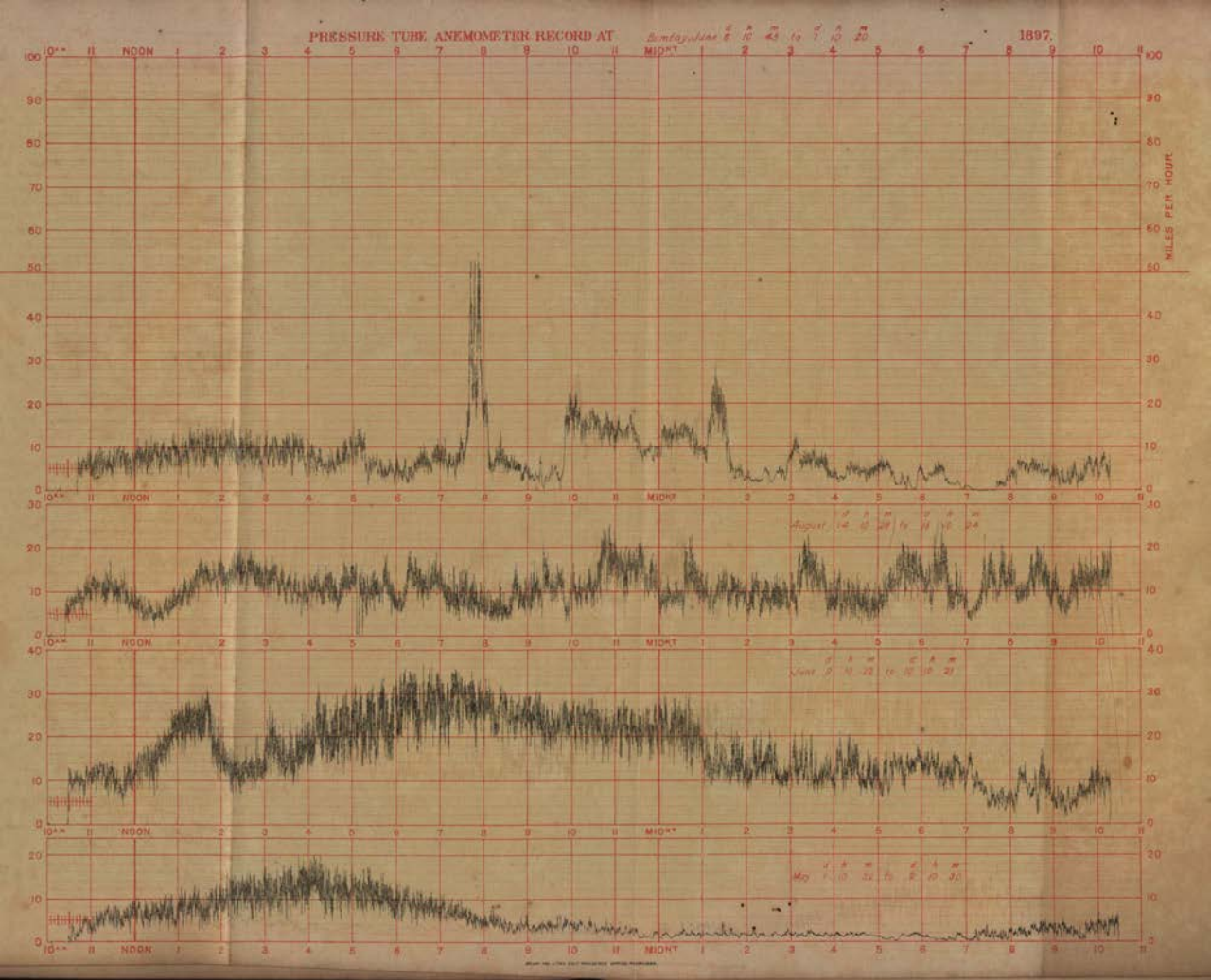
$$\text{North component of velocity of wind} = m \cos (n \times 22\tfrac{1}{2}^\circ),$$
$$\text{East component of velocity of wind} = m \sin (n \times 22\tfrac{1}{2}^\circ),$$

where m is the movement observed, and n the number of the direction space under which the wind of the hourly interval is classed. When the sign of either of these calculated quantities is negative, it implies that the wind blows from the opposite direction, *i. e.*, from south or west. The calculations are readily made by means of tables to the nearest tenth of a mile of velocity per hour. Having now substituted the two equivalent winds for the real one, we may with propriety proceed to combine together numbers of observations by algebraical addition and averaging, treating the north and east components of the wind each by themselves. The averages thus found from the observations of any given period will represent the velocity with which the wind must blow from the northward (from the southward if the sign of the average be negative) continuously for the whole period, in order that the total movement of the wind from that direction may be the same as the total movement from the same direction produced by the winds which actually blow, and similarly the velocity with which it must blow continuously from the eastward (westward if the sign of the average be negative).

No corrections have been applied to the anemograph tabulations on account of friction.

Dines Anemograph.—This instrument by R. W. Munro of London was received in January 1897 and fitted up in February on the same tower on which the old Robinson Beckley Anemograph is fixed, and it has been in action since then. The fixture is so arranged that one instrument does not in any way interfere with the action of the other. The anemograph is fixed about 3 feet high centrally on a flat platform on the top of the old Time Ball Tower and the pressure tube anemometer is located on the edge of this platform on the north-east side—the distance between the two instruments being the radius of the platform—about 6 feet. The vane of the latter is placed about 6 feet above the platform, so that it is about 3 feet above the level of the cups of anemograph. The tower is 53 feet high from the ground and 95 feet above mean sea-level and, looking at the exposed position of the tower, the two instruments have been placed in as identically analogous conditions as was possible under the circumstances. The new instrument consists of two main parts, the "head" and the "recording apparatus." The "head," which is fixed on the top platform, is composed of two parts, the moveable and the fixed. The former consists of a hollow tube (1 inch in diameter) to which is attached at right angles at top, and opening into it, another similar tube open at one end and closed at the other, where the vane is attached. The fixed part consists of three concentric tubes forming two annular spaces. The central tube, which stands higher than the middle tube by about ·7 inch, is supported a little below the top of middle tube by two radial pieces and being closed at top it serves as a pivot and support for the moveable part which just fits but turns freely round the middle concentric tube 4·5 inches long as axis. The moveable part thus opens into the inner annular space. The outer concentric tube, which is considerably shorter in length than the middle one, has some fine holes bored into the sides, the annular space between it and the middle tube being closed at top. As the wind vane attached to the moveable tube keeps the latter always facing the wind, the action in the inner annular space is compressive as the wind blows directly into it, while that in the outer annular space the air as it rushes past the small holes produces a suction effect resulting in decrease of pressure.

The recording apparatus consists of a large cylindrical vessel almost air-tight, filled with water to a certain level. In this is introduced a specially


PRESSURE TUBE ANEMOMETER RECORD AT
1897.
MILES PER HOUR
NOON
MIDNT

constructed hollow copper float, open from below and weighing about 31,940 grains, which rises or falls in response to the change of pressure of the air in the cylinder above the float and of the air within the float, caused by the action of the wind which is communicated from the "head" to the recording apparatus by two tubes (40 feet long) led by gentle curves from the former to the latter. The tube which is attached to the suction part of the "head" enters the vessel from the top lid, the other leading from the vane tube opens into and reaches the top part inside the float. As the action of the wind in the former space is to reduce the pressure, the float becomes more buoyant and rises, while the action of the wind inside the float causes increase of pressure, and thus co-operates in raising the float. The float ends in a narrow smooth rod which, passing through an almost air-tight vulcanite collar in the top lid, carries a small cup with attachment of pen, &c. On the top of the lid, a little removed from the recording pen, is fixed a small cylinder with clock-work, carrying the paper chart. The pen is so attached as just to fall on this paper by its own weight to avoid unnecessary friction between the two. When the float is put down, the pen is adjusted by the lifting screw to coincide with the zero line on the chart. The float when let go rises carrying the pen with it which is again brought carefully back just to the zero line by the addition of small weights in the cup. A displacement of the pen measuring about half a mile on the chart occurs when a weight of about 16 grains is taken out from, or introduced into, the cup. This serves as a check on the uniform working of the instrument. The variation in the pressure caused by the wind is thus recorded. The peculiar construction of the float makes the upward force measured in units of velocity to vary uniformly with the ordinate: thus a velocity of 10 miles gives an ordinate of ·6 inch on the chart, that of 20 miles 1·2 inches, and so on.

Tabulation of the anemograph is made on a table in which the days of the month are marked in numerical order in the first vertical column and the hours of the day at the head of the succeeding 24 columns where the hourly averages are entered. The twenty-sixth column gives the sum and the next column the mean hourly velocity for the day. At the bottom of the table columns are provided for the sums, means and variations. The determination of the hourly average is generally done by inspection, the hour when necessary for accuracy being sub-divided into convenient divisions. The average of these divisions is taken as the mean hourly velocity, due weight being given to the time of each sub-division. In very complicated movements and doubtful cases the planimeter is used to check the inspection results.

Four photolithographic copies of the velocity chart given on the adjoining page, represent different but typical characters of the wind. The first shows the character of the wind during a thunderstorm day, the second during a somewhat gusty day, the third during a somewhat stormy day, and the fourth during a typical usual day.

Rain Gauges.—Newman's rain gauge, which has been in use since 1845, is made of copper and exposes for the collection of rain-drops a circular surface of an average diameter of 12·035 inches, forming the top of a funnel, which opens into a cylindrical vessel below, having a diameter of 5·732 inches: a float of slightly less diameter, so as to rise and fall freely, rests upon the water in this vessel, and having a wholly convex external surface, it allows the rain as it falls to flow off and raise the level of the water and with it the float. To the middle of the float is fixed a wooden rod, graduated with divisions, each of which represents ·05 inch of rain; and the readings of this scale, which are easily estimated to fifths of a division, are made where it is cut by the upper edge of a light brass rod placed horizontally across the mouth of the funnel, but half an inch below the edge of the exposed circular surface; the scale passes through a hole in the

middle of the horizontal rod, and is thus kept always in a vertical position. The range of the scale is from 0 to 4·00 inches, and the readings of the scale have been entered in the meteorological register and the differences been taken for every interval between successive observations: the rain has accumulated in the vessel generally till the reading was somewhere above 2·00 inches, when the water was let out, by means of a brass cock at the bottom, till the reading came down to 0·00 inch. This latter reading was also maintained during intervals of dry weather—when, from evaporation, the scale would otherwise have fallen lower—by pouring small quantities of water into the gauge: the reason of this is obvious, as, if some water were not always retained, the float would sometimes rest on the bottom of the vessel and so cease to perform its function of rising equally for equal increments of rain. The scale on the wooden rod was graduated so as to agree approximately with the data—the diameters of the gauge and measuring vessel—given above. The error of the scale according to which the rod was graduated was less than a thousandth of the whole.

Newman's gauge stands on a large rectangular block of stone, in a position intermediate between the Entrance Gate, the Magnetical Observatory, and the Thermograph Shed, where the altitude of the highest neighbouring object, as seen from the gauge, is about 30°. It is supported by three feet, which are embedded with lead in holes cut in the stone block, and its circular mouth is at a height of 4½ feet above the ground and about 35 feet above the mean sea level.

Photographic rain gauge.—A description of this instrument also will be found in the Introduction to the "Bombay Magnetical and Meteorological Observations, 1871 to 1878," page xlvi. In 1897 the syphon discharges were received in glass bottles and measured by means of a graduated glass tube and a marked glass bottle holding exactly half an inch of rain.

It was mentioned in former years that the occurrence of the discharging action of the syphon was occasionally liable to some uncertainty—the water at times trickling over the bend of the tube in considerable quantities before the proper discharge commenced. After trial of many modifications in the form of the syphon one was at last hit upon, which is free from this fault, and by which the tube is, moreover, kept in a satisfactorily clean condition from beginning to end of the monsoon, simply by the washing that takes place in the ordinary automatic discharges. Since November 1884, when the new syphon was brought into use, the discharges have been regular and unfailing except on two occasions in the previous years. This year, on the 25th June and 7th July, trickling again occurred which was traced to dust particles in suspension in the rain water, deposited in the bend of the syphon. This was looked to and the syphon was cleaned with dilute nitric acid, since which the syphon has worked satisfactorily during the year. To prevent birds alighting upon the funnel, and choking it with their droppings, a conical arrangement of pointed iron spikes surrounding the funnel was attached in 1882, and was found to be effective.

Constants for converting syphon discharges into inches of rainfall.—As the surface exposed by the rain gauge funnel is 50·286 square inches, an inch of rain contains 823·955 cubic centimeters. With the aid of a cubic centimeter measure,* 412 cubic centimeters of water were poured into a narrow-necked glass bottle, and a file mark was made on the bottle neck at the level up to which the water rose. A glass tube was also graduated by means of the same cubic centimeter measure, so as to read off thousandths of an inch of rain with ease. The

* Lent by Mr. F. Chambers, whose verification data show it to be accurate to a thousandth of the 100 cubic centimeters which it is designed to measure.

bottle is filled as often as there have been discharges from the rain gauge syphon, and the final excess or defect is measured with the graduated tube. The use of the bottle began on 31st July 1879 and continued till the 26th July 1884, when it was accidentally broken. An exact copy of it, which had been prepared beforehand, was then substituted for the original bottle, and this copy is still in use.

Measurement and distribution of syphon discharges.—The discharges are measured daily, or oftener during heavy rainfall, and are of course always of an integral number. For each measurement the average value of a discharge is attributed to each of the intervals of time, shown on the rain curve, between pairs of successive discharges; and it remains then only to distribute this quantity, for each filling of the receiving vessel, by means of tabulations of the ordinates of the rain curve. When, as is often the case, the rate of fall of the rain at the time of a discharge exceeds $1\frac{1}{2}$ inch per hour, it is necessary to allow for the rain that enters the receiving vessel during the known time (16 seconds) of discharge, the allowance depending on the rate of rainfall, which is easily estimated for this purpose by noting, with the aid of an appropriate paper scale, the inclination of the rain curve immediately after the time of discharge. The aggregate of such allowances is deducted from a day's (or other) measurement before dividing the quantity equally amongst the several intervals.

Determination of scale of rainfall ordinates.—The factor for converting ordinates of the rainfall curve into inches of rainfall was found by experiments in which a determined weight or volume of distilled water was poured into the receiving vessel, and the change of length of the ordinate produced thereby was carefully measured. In an experiment made on the 5th May, 1897, the quantity of water poured into the vessel was equivalent to ·480 inch of rain, and the change of length of the ordinate ·480 of a true inch; whence the factor is found to be 1·000, which is applicable to all the rainfall registrations of the year 1897.

The tabulations are made with the true-inch scale of the thermograph tabulating instrument, using the white line as datum; and the reading of this datum that shall correspond to the reading ·000 of the rain curve, when the receiving vessel has just been discharged, is re-determined whenever the adjustment of the recording apparatus is disturbed. For this purpose an average is taken of a number of measurements for all of which the rain is falling very slowly at the time of the syphon's coming into action and for a short time longer. It is necessary to select such occasions, because at times of heavy rainfall the curve has risen sensibly before the light has had time to make a distinct impression on the sensitive paper. The mode of tabulating is (1) to set the scale on the constant reading corresponding to the white line, (2) to move the sliding piece until the index is set upon the white line, and (3) to move the sliding bar till the index is set upon the curve, and then read the scale. By setting the paper carefully, so that a considerable length of the white line is practically parallel to the lateral motion of the frame, the repetition of the first two operations of tabulation is avoided until many hourly ordinates have been read; and then a new setting of the paper is made for another stretch of the white line.

(*b*). Magnetical Instruments, 1897.

Kew Unifilar Magnetometer.—A description of this instrument, with which the observations of absolute declination and of horizontal intensity for the year 1897 have been taken, will be found on pages xxxiii to liii of the Introduction to the "Bombay Magnetical and Meteorological Observations, 1865—70"; the

description includes also an account of the situation of the instrument, of the nature and routine of the observations taken with it—with examples of observation and computation forms filled up with the figures of actual observations—and of the formulæ of reduction and the constants involved in them.

The entries in columns 1 to 17 and 19 of the Tables of Observations of Absolute Horizontal Force are copied directly from the computation form: column 18 is given to show the degree of accordance existing in the determinations from deflections with the deflecting magnet at the respective distances 0·8 foot and 1·0 foot from the deflected magnet; and the numbers in column 21 are the products of those in column 20 multiplied by the constant number ·46108.

The description, referred to above, of the observation of absolute declination will render clear the meaning of the numbers entered in each column of the Tables of Observations of Absolute Declination: all of these, except the monthly means in columns 12 and 13, are taken directly from the observation form.

Kew Dip Circles.—A description of the instrument, and of the mode of using it, is also given in the Introduction to the "Bombay Magnetical and Meteorological Observations, 1865—70," pages lvi to lix, and the following additional or corrective remarks will make it applicable to the observations of 1897:—

(1) The place of observation has been the top room of the Electrometer Tower, the dip circle having been placed on the same pillar on which the Kew unifilar magnetometer is placed in the regular observations of absolute horizontal force and absolute declination. The reading of the azimuth circle of instrument No. 49 adopted for this place has invariably been 63° 31′, and for the new instrument No. 110 by Dover Charlton is 59° 36′ determined lately in February 1897. An observation for the verification of the former reading was made on the 22nd February 1881.

(2) The dip needles used during the year 1897 with the old instrument have been as follows:—

For the regular observations:—

Dover Charlton No. 1.
„ „ No. 2.

And for supplementary observations:—

John Dover No. $\frac{2}{61}$.
Adie No. 5.
Dover Charlton No. 1.
„ „ No. 2.
„ No. 1.
„ No. 2.

(2*a*) And with the new instrument intended for survey work the needles used were as follows:—

Dover No. 3.
„ No. 4.

(3) The final cleaning of the axles of the needles has throughout been made with a clean silk cloth.

(8) Processes of Reduction and Description of the Tables of Meteorological Results, 1897.

Pressure of Vapour and additional capacity of the Air.—Having obtained, from the tabulations of the barograms and thermograms, hourly values of

barometric pressure, temperature of the air, and temperature of evaporation, the pressure of vapour was calculated for each hour with the aid of a table by the formula

$$f''=f'-\cdot01147\ (t-t')\times\frac{P-f'}{30}$$

in which t and t' denote the temperatures of the air and wet bulb thermometers respectively, f'' and f' the pressure of vapour at the temperature of the dew point and at temperature t', and P the barometric pressure. The values of the pressure of vapour at different temperatures were taken from the following table, the numbers in which have been extracted from Boileau's Collection of Tables:—

TABLE I.—*Regnault's values of the Pressure of Vapour at different Temperatures.*

Temperature.	Pressure of vapour.	Temperature.	Pressure of vapour.	Temperature.	Pressure of vapour.	Temperature.	Pressure of vapour.	Temperature.	Pressure of vapour.	Temperature.	Pressure of vapour.	Temperature.	Pressure of vapour.	Temperature.	Pressure of vapour.
o	Inch.	o	Inch.	o	Inch.	o	Inch.	o	Inch.	o	Inch.	o	Inch.	o	Inch.
35	·204	43	·278	51	·374	59	·500	67	·662	75	·868	83	1·128	91	1·455
36	·212	44	·288	52	·388	60	·518	68	·685	76	·897	84	1·165	92	1·501
37	·220	45	·299	53	·403	61	·537	69	·709	77	·927	85	1·203	93	1·548
38	·229	46	·311	54	·418	62	·556	70	·733	78	·958	86	1·242	94	1·597
39	·238	47	·323	55	·433	63	·576	71	·758	79	·990	87	1·282	95	1·647
40	·248	48	·335	56	·449	64	·596	72	·784	80	1·023	88	1·324	96	1·698
41	·257	49	·348	57	·466	65	·617	73	·811	81	1·057	89	1·366	97	1·751
42	·267	50	·361	58	·482	66	·639	74	·839	82	1·092	90	1·410	98	1·805

To find the additional capacity of the air the pressure of vapour was deducted from the number in the above table standing opposite to the temperature of the air.

Barometric Pressure.—In Table I is shown, for every day in the year, the mean of 24 hourly tabulations of the barograph, corrected* to agree with Newman's barometer No. 58;—also the mean pressure for each month and each year, and the excess of each monthly mean above the annual mean for the same year; and the principal features of the annual variation are indicated at the foot of the table. The maximum and minimum daily pressures in each month are distinguished by being printed in strong figures.

Temperature of the Air, &c.—The plan of the following tables is the same as that of Table I, but the subjects of them and the sources from which the numbers are obtained and the mode of obtaining them are as stated below:—

Table II.—Temperature of the air: derived from hourly tabulations of the thermograph dry-bulb.

Table III.—Pressure of vapour: derived from hourly tabulations of the thermograph dry-bulb and wet-bulb, and of the barograph; and calculated in the manner described above.

Table IV.—Additional capacity of the air: derived from hourly differences between the pressure of vapour corresponding to the temperature of the air and the calculated actual pressure of vapour.

Table VII.—Velocities of the north and east components of the wind: derived from hourly tabulations from the register of the Robinson-Beckley anemograph.

Table VIII.—Velocity of the wind regardless of direction: derived from hourly tabulations from the register of the Robinson-Beckley anemograph.

* In the manner described in paragraph 54 of the Introduction to the "Bombay Magnetical and Meteorological Observations for 1871 to 1878."

Table VIII *a*.—Velocity of the wind derived from hourly tabulations from the register of the Dines anemograph.

Table XI.—Extent of cloudy sky: derived from estimations made at the hours 6, 10, 14, 16 and 22 daily.

Tables VI and XII are on the same plan as Table I, except that the entries made in them are aggregates—daily, monthly and yearly—instead of mean values; and they are sufficiently explained by their several headings.

Monthly and annual range of variation of Meteorological Elements.—Table V shows the extreme limits between which the oscillations of barometric pressure, temperature of the air, pressure of vapour, and additional capacity of the air were confined in each month and in the whole year, and also the ranges of the respective oscillations.

The numbers in Table IX are derived from hourly tabulations from the register of the Robinson-Beckley anemograph. The temperatures of the ground given in Table X are derived from the readings of the several thermometers, made five times a day as regards the 1 inch and 9 inches deep thermometers, and once a day as regards the 20 inches, 60 inches and 132 inches deep thermometers. The five-day means of Table XIII are derived from hourly tabulations of the barograph (combined with readings of Newman's barometer No. 58) and thermograph, from the measurements in Newman's rain-gauge, and from hourly tabulations from the register of the Robinson-Beckley anemograph. In other respects these tables require no explanation beyond their titles, the headings of the several columns, and the foot notes.

(9) NOTES ON INSTRUMENTAL CHANGES AND ON ALL IRREGULARITIES OR DEPARTURES FROM THE ROUTINE OF OBSERVATION OR REDUCTION IN 1897.

Robinson-Beckley Anemograph.—External parts painted on May 2 and December 30. Vanes cleaned and adjusted on April 4 and 5. The action of the vanes found sluggish, due to low velocity on April 1, 2 and 16. Velocity spindle found lifted off the pivot during stormy weather and stopped the motion of the spindle on June 6, 8, 9, 11 and 13. The aggregate of all the interruptions of the instrument in the year 1897 was $20^{h}\ 1^{m}$: the loss of record was, however, rarely complete, and values partly or entirely interpolated have been inserted whenever the interruption was not prolonged. To aid in the making of interpolations, it has been customary, whenever the action of the instrument was voluntarily interrupted for more than one hour, to observe the direction of the wind by estimation, and to record the readings of a small auxiliary velocity measurer put up for the occasion. No occasion, however, for the use of the auxiliary velocity measurer was necessary, as in all cases the interruptions were of short duration and were substituted by values obtained from Dines record from the constant factor determined between the two instruments. No complete day's records have been omitted in the formation of monthly abstracts.

Dines Anemograph.—The instrument was fixed and adjusted in February and the record has run continuously from March 1897. As the instrument was freshly put up, the aggregate of interruptions of the instrument during the period was $1^{d}\ 5^{h}\ 14^{m}$ due to casual failure of the pen to record the fluctuations, to re-adjustment of the inclination of pen, and to occasional, though rare, contact of glass cover with cylinder. The record for 16th March was wholly rejected, as the number of tabulations lost was considerable, the other interruptions during the period were always of short duration and the interpolation was made from Robinson Beckley's record by the constant determined between the two instruments for the period. Short interruptions caused by the regular change of paper every day for both anemometers, if not unusually prolonged, are not included in the above aggregate.

Method of interpolation in photographic tabulations.—When for any reason the traces furnished by the photographic self-registering instruments are interrupted, and the interruption includes the moments when one or more hourly tabulations should be made, these last are either substituted by the corresponding eye-observations, if the hours should happen to be any of the five regular observation hours, or if special eye-observations were taken for the purpose, or else, if no eye-observations are available, they are interpolated. Interpolation is resorted to rarely and only in case of accidents, otherwise eye-observations are always made so as to keep the record unbroken. If the interruption lasts for less time than one hour, the interpolation is made on the assumption that the rate of change of the phenomenon from its value at the beginning to its value at the end of the interruption was uniform, providing that the parts of the curve immediately preceding and immediately following the gap were, in appearance, continuations of the straight line connecting the extremities of the gap. If the last condition is not satisfied, or if the gap, taking account of points inserted by means of eye-observations, is of greater length than one hour, the interpolation is made between the next preceding and the next following hourly entries, first, by allowing for the known *normal* rate of change of the phenomenon between those hours in the same month, and then by assuming that any additional change, shown by the difference between the values of the phenomenon at the two extreme hours, has grown at a uniform rate. Interpolated values are entered in the abstract sheets with enclosing square brackets—inserted eye-observations between parentheses.

Barograph.—No tabulation was obtained for 16^h of 12th June 1897 on account of disturbance caused by the Assam earthquake and another for 2^h of 16th September 1897 on account of stoppage of clock. Interpolated values were adopted in both cases.

Occasional, though rare, failure of the bi-hourly stops to act, has caused no loss of record.

The aggregate of all the interruptions of the barograph in the year 1897 was $0^h\ 43^m$, and the number of hourly tabulations lost was 2, which were substituted by interpolated values. Short interruptions caused by the regular change of photographic papers and by change of lamps, if not unusually prolonged, are not included in the above aggregate, nor in the aggregates of interruptions of the thermograph that follow further on.

Thermograph dry-bulb.—No tabulations were obtained for the following hours for the several reasons stated below, but eye-observations were available in all cases but one and were adopted for the hours marked within parentheses; and for the single hour where no eye-observation was available, interpolated value was substituted.

(1) Examination of the faulty wet-bulb thermometer and substitution of a new wet-bulb thermometer in its place: for 1897 February 9^d (10^h) to (13^h), 10^d (11^h) and (12^h), 15^d (15^h) to (17^h), 18^d (11^h) to (14^h), 22^d (14^h) to (16^h): March 4^d (13^h) to (17^h).

(2) Clock going out of order owing to derangement of the bi-hourly fan: for 1897 July 8^d 11^h.

Occasional, though rare, failure of the bi-hourly stops to act, has caused no loss of record.

The aggregate of all the interruptions of the thermograph dry-bulb in the year 1897 was $22^h\ 48^m$ and the number of hourly tabulations lost was 22, and of these 21 were substituted by eye-observations, leaving only one to be interpolated.

Thermograph wet-bulb.—No tabulations were obtained for the following hours for the several reasons stated below, but eye-observations were available in all cases but four, and were adopted for the hours marked within parentheses;

and for the rest of the four hours where no eye-observations were available, interpolated values were substituted.

(1) Examination of the faulty wet-bulb thermometer and substitution of a new wet-bulb thermometer in its place: for 1897 February 9^d (10^h) to (13^h), 10^d (11^h) and (12^h), 15 (15^h) to (17^h), 18^d (11^h) to (14^h), 22^d (14^h) to (16^h), and March 4^d (13^h) to (17^h).

(2) Comparison of the thermometer with Kew standard for 1897 February 24^d (11^h) to (17^h); March 4^d (11^h) and (12^h), and 9^d (12^h) to (18^h).

(3) Muslin of wet-bulb thermometer removed for comparison with dry-bulb thermometer: for 1897 March 8^d (15^h).

(4) Owing to drying of the muslin covering of the bulb and imperfect capillary action of threads: for 1897 April 13^d (14^h), 15^h, (16^h), 17^h and 18^h.

(5) Clock going out of order owing to derangement of the bi-hourly fan: for 1897 July 8^d 11^h.

(6) The scale of the new thermometer being comparatively large, the exceptionally low temperature carried the speck of light beyond the paper: for 1897 December 17^d (6^h) and (7^h).

Occasional, though rare, failure of the bi-hourly stops to act, has caused no loss of record.

The aggregate of all the interruptions of the thermograph wet-bulb in the year 1897 was 2^d 8^h 49^m, made up chiefly of the examination of the faulty wet-bulb, its removal and substitution of a new one, and of short intervals of time occupied in cleaning and renewing the muslin coverings of the bulbs and the bundles of threads connecting them with the supply of water. The number of hourly tabulations lost was 45, of which 41 were substituted by eye-observations, leaving only four to be interpolated.

Self-registering Rain-gauge.—No hourly tabulations were lost in the year 1897.

N. A. F. MOOS,
Director.

Colaba Observatory, October 1898.

TABLES OF RESULTS

DERIVED

FROM THE CONTINUOUS REGISTRATIONS OF AUTOMATIC METEOROLOGICAL INSTRUMENTS

AND FROM

METEOROLOGICAL OBSERVATIONS,

1897.

TABLES OF RESULTS

DERIVED FROM THE

METEOROLOGICAL OBSERVATIONS MADE DAILY AT 6, 10, 14, 16 AND 22 HOURS,

1897.

FIVE-DAY MEANS,

1897.

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TABLE I.—Barometric Pressure, 1897.

Height of Barometer above mean Sea-level = 37 feet.

1897. Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
1	29·961	29·940	29·917	29·840	29·744	29·756	29·743	29·619	29·774	29·787	29·940	**29·876**
2	·933	·918	·910	·820	·782	·756	**·773**	·703	·745	·780	·898	·906
3	·943	·901	·888	·830	·770	·709	·738	·737	·750	·781	·908	·908
4	·934	·906	·833	·859	·755	·666	·657	·690	·746	·775	·922	·916
5	·935	·948	·836	·870	·760	·651	·619	·626	·779	·782	·920	·962
6	·957	·927	·863	·868	·787	·638	·631	·581	**·839**	·834	·891	**30·016**
7	·936	·907	·861	·825	·773	·592	·618	**·550**	·832	·831	·864	29·993
8	·903	·930	·860	·769	·780	·588	·551	·550	·785	·828	·884	·943
9	·900	·911	·918	·792	·811	·652	·478	·564	·758	·842	·886	·924
10	·929	·907	**·959**	·821	·791	·777	**·447**	·614	·709	·874	·876	·923
11	·937	·897	·891	·845	·791	·751	·472	·643	**·662**	·886	·825	·929
12	·951	·898	·852	·823	·802	·655	·593	·650	·717	·850	**·824**	·940
13	·922	·886	·867	·807	**·824**	·643	·653	·631	·771	·794	·838	·945
14	·954	·894	·898	·789	·783	·640	·684	·611	·783	**·772**	·900	·961
15	**30·020**	·875	·936	·800	·807	·612	·700	·626	·753	·790	·919	·942
16	29·994	**·833**	·915	·830	·820	·586	·719	·663	·733	·814	·907	·909
17	·955	·835	·895	·859	·784	·579	·682	·709	·760	·833	·917	·924
18	·976	·870	·844	·877	·750	·622	·611	·737	·770	·836	·931	·946
19	·993	·895	·802	**·886**	·760	·607	·604	·725	·727	·822	·927	·958
20	·961	·890	·820	·854	·777	·601	·607	·742	·731	·842	·905	·958
21	·988	·917	·819	·843	·778	·559	·642	·751	·713	·835	·890	·967
22	·995	·938	·820	·864	·758	**·544**	·688	·721	·712	·838	·911	·972
23	·970	·903	·847	·811	·739	·621	·691	·732	·719	·837	·923	·984
24	·960	**·954**	·853	·825	·780	·657	·651	·722	·734	·837	·930	·990
25	·936	·930	·840	·809	·743	·676	·628	·667	·730	·859	**·946**	·962
26	·948	·897	**·800**	·785	·774	·735	·613	·630	·772	·910	·904	·945
27	·923	·900	·806	·784	·770	·763	·580	·632	·818	·934	·883	·943
28	·898	·893	·846	·780	·771	**·781**	·560	·686	·823	·898	·891	·950
29	**·883**		·901	·743	**·737**	·780	·607	·739	·817	·878	·885	·983
30	·902		·865	**·735**	·740	·721	·645	·780	·819	·920	·878	30·012
31	·932		·857		·752		·610	**·804**		**·945**		29·990
Monthly Mean.	29·946	29·904	29·865	29·821	29·774	29·664	**29·629**	29·672	29·759	29·840	29·897	**29·951**
Annual Variation ...	+·136	+·094	+·055	+·011	—·036	—·146	—·181	—·138	—·051	+·030	+·087	+·141

	in.
Annual mean	29·810
The greatest mean daily barometric pressure in the year (that of 15th January) was	30·020
The least do. do. do. (that of 10th July) was	29·447
Difference =	0·573

TABLE II.—Temperature of the Air, 1897.

1897. Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	°	°	°	°	°	°	°	°	°	°	°	°
1	72·9	72·8	**74·3**	79·8	83·1	86·0	85·0	81·1	81·7	80·9	79·8	75·3
2	72·7	73·1	77·3	79·7	**82·9**	86·7	85·1	82·2	81·7	82·4	78·5	76·0
3	73·3	72·4	78·1	78·3	82·9	86·4	**85·2**	82·2	82·3	80·6	78·7	75·9
4	76·3	73·4	76·6	**77·3**	83·3	86·5	84·7	81·6	82·2	80·7	78·3	76·0
5	77·3	73·6	75·6	79·0	84·7	**86·9**	83·0	81·6	81·3	81·1	**80·0**	76·6
6	78·1	73·8	76·2	79·4	84·9	86·7	81·1	81·1	81·6	80·5	79·2	**77·7**
7	77·1	74·6	75·9	80·5	84·3	86·5	79·1	80·5	80·5	81·1	79·1	76·7
8	77·8	75·3	75·4	83·0	84·1	85·8	80·9	80·3	81·1	81·8	79·1	74·7
9	**78·3**	75·0	75·8	82·9	84·1	85·6	81·6	81·1	80·1	82·6	79·1	74·5
10	77·6	73·8	75·6	82·3	84·0	86·8	81·0	**78·6**	81·3	82·8	78·1	75·4
11	75·7	72·4	75·1	81·5	83·9	83·7	81·0	79·7	**77·5**	82·4	79·1	74·5
12	74·3	72·0	75·2	83·0	84·1	85·9	83·6	80·4	80·2	81·6	80·0	74·8
13	72·6	72·7	75·5	84·0	84·1	83·7	82·1	81·8	80·8	82·3	79·5	75·4
14	74·0	74·3	76·1	83·0	83·9	85·7	83·1	80·1	81·6	**83·2**	77·6	75·1
15	70·7	74·3	76·7	82·2	84·5	86·2	81·0	79·3	81·0	82·7	77·7	74·7
16	**68·2**	74·9	77·3	83·6	85·1	86·1	78·6	80·8	81·4	82·3	77·5	75·3
17	68·9	75·4	78·2	83·8	85·2	85·3	80·6	81·2	81·1	81·4	77·3	73·7
18	72·7	76·2	78·5	83·2	84·9	**80·4**	79·7	81·3	81·4	80·1	77·3	**72·6**
19	71·1	**76·6**	78·2	83·3	84·4	83·8	81·8	81·6	82·2	80·1	76·9	74·1
20	69·0	75·7	76·9	82·6	84·7	84·9	80·0	80·4	79·5	**79·6**	76·2	76·0
21	70·5	74·9	77·2	82·5	84·9	83·1	80·2	81·0	82·0	79·9	76·4	75·6
22	72·5	74·6	77·5	82·9	84·6	83·3	79·9	80·2	**83·0**	80·6	76·2	74·1
23	74·0	74·9	78·3	82·6	84·5	84·0	78·8	81·4	80·7	82·1	77·9	73·8
24	74·6	75·1	77·7	82·1	85·3	82·9	**78·0**	82·0	81·0	82·0	77·7	73·8
25	73·7	73·4	78·1	82·4	85·2	84·5	79·3	81·4	81·0	80·9	77·1	75·2
26	73·7	74·1	78·7	83·4	85·1	84·3	79·5	82·1	78·1	80·8	77·0	74·5
27	73·7	74·3	78·5	85·6	86·2	83·7	81·4	81·8	81·1	82·1	77·4	72·7
28	73·1	**71·8**	78·6	**86·3**	86·5	84·9	80·7	81·9	80·9	82·5	77·2	72·7
29	72·2		77·5	84·9	86·1	84·9	80·4	81·8	81·3	80·7	77·0	74·0
30	71·5		78·2	84·6	86·2	83·6	81·8	**82·3**	80·8	80·2	**74·9**	74·3
31	72·3		**78·9**		**86·6**		82·0	81·7		80·4		74·6
Monthly Mean	**73·6**	74·1	77·0	82·3	84·6	**85·0**	81·3	81·1	81·0	81·4	77·9	74·9
Annual Variation ...	—5·9	—5·4	—2·5	+2·8	+5·1	+5·5	+1·8	+1·6	+1·5	+1·9	—1·6	—4·6

	°
Annual mean	79·5
The greatest mean daily temperature of the air in the year (that of 5th June) was	86·9
The least do. do. do. (that of 16th January) was	68·2
Difference =	18·7

Table III.—Pressure of Vapour, 1897.

1897. Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
1	0·519	0·574	0·648	0·810	0·877	0·914	0·911	0·904	**0·860**	0·909	0·695	0·648
2	·589	**·505**	·656	·774	·873	·910	·907	**·936**	·895	**·952**	·678	**·702**
3	·635	·508	·604	·702	·871	·932	·911	·922	·905	·919	**·731**	·692
4	·704	·597	·654	**·687**	·840	·939	·900	·927	·900	·906	·717	·644
5	**·736**	·647	·698	·731	**·833**	·969	·938	·909	·893	·914	·692	·637
6	·726	·640	·716	·768	·877	·985	·919	·917	·896	·862	·686	·598
7	·720	·621	·699	·804	·859	·999	·911	·921	·883	·857	·697	·578
8	·695	·604	·674	·718	·877	·970	·942	·915	·863	·858	·697	·582
9	·667	·536	·701	·883	·844	·957	·937	·932	·866	·916	·660	·601
10	·711	·570	·615	·882	·880	·978	·940	·909	·917	·932	·695	·628
11	·666	·559	**·543**	·810	·874	·954	·933	·920	·864	·880	·703	·595
12	·643	·533	·554	·830	·883	·995	·938	·913	·882	·893	·723	·620
13	·605	·514	·657	·830	·867	·971	·918	·925	·889	·914	·672	·591
14	·591	·613	·694	·778	·884	·990	·937	·908	·897	·931	·641	·592
15	·525	·602	·733	·871	·897	·995	·923	·911	·907	·825	·654	·565
16	·428	·547	·730	**·935**	·892	**1·007**	·888	·919	·921	·825	·676	·487
17	·464	·620	·714	·916	·899	0·999	·913	·915	·897	·755	·626	**·433**
18	·568	·678	·700	·878	·905	·899	·904	·911	·862	**·699**	·662	·500
19	·499	·623	·709	·853	·901	·969	·940	·902	·885	·704	·634	·542
20	**·398**	·645	·700	·850	·893	·972	·928	·899	·884	·720	**·559**	·541
21	·482	·627	·705	·872	·892	·945	·925	·909	·929	·732	·602	·537
22	·568	·674	·730	·860	·901	·968	·928	·886	**·975**	·889	·603	·560
23	·699	**·691**	·747	·855	·915	·938	·893	·907	·917	·929	·623	·597
24	·678	·626	·732	·852	·920	·925	**·883**	·896	·941	·885	·629	·587
25	·554	·552	·732	·875	·927	·948	·899	·898	·939	·825	·591	·552
26	·557	·534	·756	·902	·970	·939	·906	·876	·887	·860	·636	·556
27	·546	·601	**·760**	·866	**·982**	·901	**·949**	·890	·911	·907	·645	·567
28	·528	·558	·724	·857	·968	·908	·946	·876	·905	·829	·646	·588
29	·511		·684	·856	·940	**·897**	·935	·849	·922	·749	·577	·600
30	·575		·731	·900	·940	·899	·936	**·847**	·912	·769	·615	·576
31	·576		·744		·943		·930	·851		·736		·548
Monthly Mean...	0·592	0·593	0·692	0·834	0·898	**0·952**	0·922	0·903	0·900	0·848	0·656	**0·582**
Annual Variation ...	—·189	—·188	—·089	+·053	+·117	+·171	+·141	+·122	+·119	+·067	—·125	—·199

	in.
Annual mean	0·781
The greatest mean daily pressure of vapour in the year (that of 16th June) was	1·007
The least do. do. do. (that of 20th January) was... ...	0·398
Difference =	0·609

TABLE IV.—Additional Capacity of the Air, 1897.

1897. Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
1	0·298	0·234	0·209	**0·210**	0·258	0·331	0·295	0·156	**0·224**	0·150	0·332	0·237
2	·220	·311	·289	·245	·254	**·364**	**·301**	·163	·189	·160	·302	**·201**
3	·189	·291	**·363**	·268	·258	·328	·301	·179	·198	**·128**	**·254**	·208
4	·210	·231	·269	·256	·302	·333	·294	·151	·196	·145	·261	·259
5	·206	·185	**·191**	·283	**·361**	·311	·191	·169	·175	·151	·342	·289
6	·240	·197	·191	·240	·324	·291	·142	·143	·186	·183	·318	·360
7	·217	·240	·203	·241	·320	·267	·082	·121	·158	·207	·304	·348
8	·265	·275	·213	**·416**	·297	·273	·115	·121	·199	·230	·304	·284
9	·312	**·336**	·193	·246	·327	·271	·143	·130	·165	·201	·341	·259
10	·239	·266	·273	·223	·290	·298	·119	**·069**	·152	·193	·272	·263
11	·224	·238	·332	·269	·292	·204	·125	·093	·080	·230	·296	·264
12	·208	·254	·326	·300	·287	·247	·214	·124	·148	·192	·308	·249
13	·198	·296	·237	·340	·304	·184	·179	·160	·163	·194	·350	·296
14	·254	·239	·212	·354	·280	·241	·198	·121	·183	·209	·311	·284
15	·227	·242	·191	·233	·290	·257	·136	·091	·154	·299	·299	·302
16	·262	·323	·210	·218	·321	·241	·092	·132	·152	·282	·271	·399
17	·248	·266	·254	·246	·314	·221	·130	·149	·167	·322	·321	**·405**
18	·235	·230	·281	·260	·299	**·139**	·109	·159	·211	**·335**	·280	·310
19	·265	·294	·259	·290	·283	·189	·149	·178	·218	·331	·296	·309
20	**·317**	·246	·228	·266	·299	·227	·097	·139	·123	·298	·350	·365
21	·268	·242	·231	·241	·308	·189	·107	·151	·166	·294	·318	·359
22	·296	·186	·215	·269	·288	·171	·093	·147	·160	·156	·307	·292
23	**·147**	**·178**	·226	·261	·272	·226	**·076**	·166	·135	·170	·344	·245
24	·183	·248	·221	·246	·298	·201	·076	·196	·121	·208	·331	·259
25	·281	·272	·233	·236	·286	·240	·101	·174	·121	·230	·350	·333
26	·277	·312	·229	·246	**·239**	·237	·103	·220	**·075**	·193	·299	·306
27	·290	·251	·216	·367	·269	·253	·125	·196	·152	·189	·303	·243
28	·293	·230	·256	·402	·299	·294	·102	·213	·149	·287	·300	·224
29	·285		·260	·351	·309	·305	·103	·235	·145	·300	**·358**	·244
30	·202		·239	·291	·314	·253	·151	**·259**	·143	·265	·256	·276
31	·220		·247		·326		·164	·232		·309		·318
Monthly Mean.	0·242	0·254	0·242	0·277	0·296	0·253	**0·149**	0·159	0·160	0·227	**0·309**	0·290
Annual Variation ..	+·004	+·016	+·004	+·039	+·058	+·015	—·089	—·079	—·078	—·011	+·071	+·052

	in.
Annual mean	0·238
The greatest mean daily additional capacity of the air in the year (that of 8th April) was ...	0·416
The least do. do. do. (that of 10th August) was ...	0·069
Difference = 0·347	

Maxima and Minima of different Meteorological Elements, 1897.

TABLE V.—*In which are collected the individual observations in each month of the year, which showed the greatest and the least values of the following elements, viz., Height of Barometer, corrected for Temperature; Temperature of Air; Pressure of Vapour; and Additional Capacity of Air.*

1897.	HEIGHT OF BAROMETER.			TEMPERATURE OF AIR.			PRESSURE OF VAPOUR.			ADDITIONAL CAPACITY.		
Month.	Greatest.	Least.	Range.	Greatest.	Least.	Range.	Greatest.	Least.	Range.	Greatest.	Least.	Range.
	in.	in.	in.	°	°	°	in.	in.	in.	in.	in.	in.
January ...	30·081	29·833	0·248	86·9	62·1	24·8	0·847	0·281	0·566	0·723	0·057	0·666
February .	·035	·780	·255	81·3	65·1	16·2	·755	·347	·408	·551	·061	·490
March ...	·042	·723	·319	84·0	67·9	16·1	·807	·389	·418	·575	·048	·527
April ...	29·943	·675	·268	91·0	72·0	19·0	·988	·465	·523	·644	·081	·563
May ...	·891	·678	·213	91·2	78·8	12·4	1·023	·785	·238	·528	·147	·381
June ...	·871	·480	·391	91·3	76·1	15·2	·104	·804	·300	·557	·080	·477
July ...	·816	·385	·431	88·5	74·7	13·8	·028	·776	·252	·406	·041	·365
August ...	·845	·502	·343	85·6	77·2	8·4	0·999	·795	·204	·353	·038	·315
September.	·889	·612	·277	88·8	75·8	13·0	1·049	·802	·247	·393	·045	·348
October ...	30·019	·708	·311	88·6	73·6	15·0	·013	·560	·453	·665	·056	·609
November.	·027	·758	·269	90·4	69·8	20·6	0·854	·391	·463	·922	·078	·844
December .	·108	·835	·273	87·0	67·1	19·9	·829	·286	·543	·938	·058	·880
Year ...	30·108	29·385	0·723	91·3	62·1	29·2	1·104	0·281	0·823	0·938	0·038	0·900

Rainfall, 1897.

TABLE VI.—*Total fall of rain (in inches) as measured by F. Chambers's Self-registering Gauge, the funnel of which is 28 feet above the ground.*

1897. Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
						in.	in.	in.	in.	in.		
1	...	...	...	...	...	...	...	0·34	...	0·48	...	...
2	...	...	...	...	...	...	...	0·01	0·12	0·82	...	...
3	...	...	...	...	...	...	...	0·07	...	0·56	...	...
4	...	...	...	...	...	...	0·04	0·62	0·52	0·30	...	...
5	...	...	...	...	...	...	0.14	0·10	0·50	0·13	...	...
6	...	...	...	...	...	...	0·89	0·68	1·09	0·17	0·07	...
7	...	...	...	...	...	...	0·03	3·79	1·04	0·76	...	...
8	...	...	...	...	...	...	0·17	0·31	0·21	0·57	...	...
9	...	...	...	...	...	...	...	0·02	0·61	0·36	...	...
10	...	...	...	...	...	...	0·01	0·74	2·68	1·67	...	...
11	...	...	...	...	...	...	1·48	2·06	0·53	4·86	...	...
12	...	...	...	...	...	...	...	0·04	0·27	0·09	...	...
13	...	...	...	...	...	...	2·76	0·79	0·10	0·38	...	...
14	...	...	...	...	...	...	0·09	0·24	1·82	...	...	...
15	...	...	...	...	...	...	0·17	1·92	2·05	0·41	...	...
16	...	...	...	...	...	...	0·04	4·77	0·28	0·59	...	...
17	...	...	...	...	...	...	0·12	1·11	0·08	...	...	...
18	...	...	...	...	...	...	2·37	1·18	0·23	...	...	...
19	...	...	...	...	...	...	0·83	0·17	0·08	0·04	...	...
20	...	...	...	...	...	...	0·02	1·67	0·60	2·33	...	...
21	...	...	...	...	...	...	0·94	0·33	0·04	...	...	...
22	...	...	...	...	...	...	0·92	1·74	0·20	0·29	...	...
23	...	...	...	...	...	...	0·12	2·10	0·02	0·66	...	...
24	...	...	...	...	...	...	0·42	1·40	0·06	0·89	...	...
25	...	...	...	...	...	...	0·10	1·51	0·15	4·48	...	...
26	...	...	...	...	...	...	0·17	0·85	...	0·34	...	...
27	...	...	...	...	...	...	...	0·25	0·11	...	...	...
28	...	...	...	...	...	...	...	0·44	0·02	0·41	...	...
29	...	...	...	...	...	...	0·06	0·74	0·02	...	...	...
30	...	...	...	...	...	...	0·54	0·42	...	0·12	...	...
31	...	...	...	...	...	...	...	0·10	...	...	...	...
Monthly Total.	...	...	...	...	...	13·25	29·55	13·43	20·56	2·36	...	...
Number of rainy days.	...	...	...	...	...	21	28	28	22	6	...	...

Total fall of rain in the year ... ... 79·15 inches.
Total number of rainy days in the year 105
The greatest daily fall of rain in the year (that of 11th September) was ... ... 4·86 inches.
No rain fell in the months of January, February, March, April, May, November and December, nor on any of the days left blank in the above table.

Mean Daily Velocities of the North and East Components of the Wind, 1897.

TABLE VII.—*Showing the Mean Velocities of the North or South and East or West Components of the Winds which blew on each day of the year 1897.*

In Miles per Hour.

1897. Date.	MONTH.																							
	January.		February.		March.		April.		May.		June.		July.		August.		September.		October.		November.		December.	
	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.
1 ...	10·1 N	2·4 W	8·7 N	0·1 E	11·7 N	4·7 W	4·8 N	7·3 W	0·5 S	5·8 W	1·2 S	6·7 W	0·4 S	10·6 W	6·0 S	14·9 W	0·1 N	5·0 W	3·3 N	1·5 E	5·9 N	2·0 E	2·3 N	2·2 E
2 ...	8·7 N	3·5 W	11·9 N	5·8 W	12·5 N	5·0 W	4·8 N	7·8 W	0·4 N	6·6 W	0·5 S	7·0 W	0·2 S	10·1 W	6·0 S	10·4 W	1·0 S	6·4 W	1·9 N	1·0 W	4·3 N	0·7 E	3·5 N	0·9 E
3 ...	5·3 N	0·8 W	10·4 N	3·4 W	8·4 N	3·7 W	5·2 N	7·7 W	2·6 N	7·0 W	2·6 N	8·5 W	2·1 S	10·4 W	5·7 S	15·3 W	1·3 S	6·9 W	1·4 S	1·0 W	7·6 N	0·1 W	4·2 N	0·3 E
4 ...	5·6 N	1·0 E	0·2 S	1·4 W	6·4 N	5·1 W	1·3 N	5·4 W	1·2 N	5·5 W	5·5 N	10·3 W	3·3 S	9·2 W	5·8 S	20·3 W	2·4 S	10·7 W	3·3 S	1·2 W	6·8 N	1·4 W	1·8 N	2·2 E
5 ...	6·1 N	1·6 W	0·1 S	2·2 W	4·9 N	6·4 W	1·0 N	6·1 W	1·9 S	7·0 W	1·8 N	7·3 W	9·3 S	3·1 W	8·2 S	20·5 W	2·8 S	11·4 W	11·3 S	3·4 E	7·3 N	4·0 E	5·5 N	3·3 E
6 ...	5·3 N	0·1 W	9·5 N	3·8 W	5·1 N	4·8 W	1·8 N	3·9 W	0·2 S	8·7 W	0·0	4·8 W	15·2 S	1·8 E	3·7 S	25·4 W	3·9 S	11·3 W	12·8 S	1·4 E	6·2 N	2·9 E	5·3 N	7·2 E
7 ...	5·5 N	1·5 W	7·4 N	3·5 W	0·7 N	4·0 W	4·9 N	5·0 W	0·6 N	8·3 W	1·3 N	2·6 W	8·8 S	0·0	0·4 S	26·0 W	2·1 S	11·4 W	4·8 S	1·1 E	3·6 N	2·5 E	4·1 N	6·0 E
8 ...	4·9 N	0·3 W	10·9 N	4·8 W	2·6 N	3·3 W	8·8 N	5·2 W	6·0 N	8·2 W	3·7 S	0·2 W	13·7 S	0·6 E	3·2 S	21·2 W	4·9 N	8·2 W	0·7 N	3·0 W	5·2 N	4·8 E	4·3 N	1·2 E
9 ...	3·0 N	0·1 E	10·1 N	4·7 W	3·9 S	4·4 W	6·8 S	4·3 W	3·9 N	8·4 W	21·5 S	3·6 E	10·2 S	0·8 W	4·5 S	16·3 W	7·7 N	5·6 W	7·1 N	2·0 W	5·2 N	4·1 E	5·2 N	0·6 E
10 ...	1·6 N	0·0	8·3 N	3·7 W	10·7 N	5·4 W	2·6 S	5·8 W	7·1 N	9·4 W	6·2 S	8·6 W	20·3 S	2·8 W	4·3 S	19·0 W	7·9 N	9·6 W	5·2 N	0·9 E	6·3 N	1·4 W	1·5 N	1·9 E
11 ...	8·6 N	4·4 W	7·9 N	5·9 W	10·5 N	5·0 W	7·5 N	6·6 W	8·6 N	9·7 W	3·5 N	10·9 W	8·1 S	19·3 W	1·3 S	13·2 W	0·6 S	13·6 W	4·7 N	1·8 E	9·5 N	2·2 W	2·2 N	0·8 E
12 ...	8·1 N	1·6 W	10·0 N	1·1 W	5·9 N	3·8 W	9·8 N	6·5 W	3·2 N	7·9 W	4·8 N	11·0 W	7·1 S	16·6 W	5·2 S	16·5 W	9·5 S	6·5 W	3·3 N	1·2 E	7·5 N	1·5 W	7·3 N	0·3 E
13 ...	4·3 N	0·1 E	5·4 N	4·1 W	4·6 N	5·1 W	10·3 N	7·2 W	3·4 N	7·8 W	4·9 S	7·6 W	7·8 S	15·9 W	5·6 S	14·3 W	12·7 S	2·5 W	1·2 N	0·7 W	5·6 N	2·6 E	8·3 N	0·8 E
14 ...	4·6 N	5·4 W	0·2 N	2·8 W	0·8 N	5·1 W	7·6 N	6·3 W	6·0 N	7·6 W	1·2 N	11·1 W	6·8 S	17·3 W	5·2 S	15·0 W	14·3 S	0·5 W	4·5 N	0·9 W	4·3 N	1·4 E	8·9 N	0·7 W
15 ...	10·7 N	3·4 W	4·9 N	2·8 W	0·9 N	4·6 W	4·2 N	4·8 W	0·6 S	6·3 W	3·4 N	15·8 W	6·6 S	16·2 W	4·8 S	16·5 W	11·3 S	0·9 W	5·7 N	0·0	5·7 N	0·7 E	10·1 N	0·4 W
16 ...	8·8 N	1·5 E	11·4 N	4·6 W	5·5 N	5·2 W	5·7 S	5·1 W	2·2 S	6·8 W	0·0	16·3 W	6·3 S	9·4 W	5·3 S	14·1 W	6·0 S	3·0 W	6·8 N	1·1 W	8·2 N	0·2 W	9·0 N	7·9 E
17 ...	1·0 N	1·9 W	3·3 N	2·5 W	8·0 N	7·7 W	7·0 S	4·0 W	0·0	8·2 W	0·8 N	18·5 W	1·4 S	18·6 W	7·1 S	9·0 W	0·9 S	2·2 W	7·7 N	2·3 W	6·5 N	0·6 E	8·2 N	5·0 E
18 ...	0·1 N	3·8 W	3·0 N	1·6 W	11·3 N	5·9 W	2·0 S	5·0 W	1·1 N	6·2 W	3·0 S	4·0 W	0·3 N	15·9 W	6·4 S	8·4 W	1·5 S	3·0 W	7·8 N	1·3 W	5·2 N	1·6 E	7·7 N	1·7 E
19 ...	8·7 N	2·1 W	6·6 N	5·6 W	7·1 N	5·7 W	4·3 S	5·8 W	0·2 N	5·4 W	1·2 S	15·2 W	2·9 S	12·7 W	7·4 S	9·6 W	5·3 N	3·5 W	10·7 N	3·1 W	7·0 N	0·3 W	6·0 N	0·7 E
20 ...	11·7 N	3·8 W	5·5 N	4·2 W	1·4 N	5·8 W	2·6 N	7·2 W	1·8 S	5·6 W	5·3 S	12·8 W	9·2 S	4·5 W	8·0 S	11·2 W	7·4 N	8·5 W	6·2 N	1·2 W	6·2 N	0·1 W	8·4 N	5·2 E
21 ...	9·4 N	3·8 W	6·5 N	5·4 W	2·7 N	4·6 W	7·6 N	7·7 W	0·5 N	6·9 W	5·7 S	14·5 W	9·5 S	3·7 W	5·6 S	13·5 W	8·0 N	1·8 W	6·5 N	1·8 W	5·6 N	3·5 E	7·9 N	5·9 E
22 ...	8·0 N	3·0 W	8·1 N	5·7 W	3·0 N	3·5 W	2·4 N	5·8 W	2·8 N	8·3 W	1·8 S	20·8 W	4·1 S	6·9 W	2·3 S	15·5 W	2·8 N	2·1 E	6·7 S	0·0	1·1 N	1·8 E	6·6 N	3·2 E
23 ...	6·5 N	3·8 W	4·9 N	7·1 W	2·7 N	5·5 W	8·5 N	6·5 W	3·2 N	5·2 W	7·7 S	17·9 W	1·9 S	7·8 W	2·2 S	10·8 W	0·7 S	1·7 E	5·2 S	0·9 W	4·3 N	5·1 E	4·2 N	1·7 E
24 ...	10·5 N	6·1 W	11·2 N	8·2 W	4·3 N	5·6 W	9·1 N	7·8 W	1·4 N	6·9 W	7·0 S	17·5 W	2·6 S	7·0 W	0·9 N	8·6 W	3·3 S	1·8 E	3·7 N	4·9 W	4·6 N	3·3 E	5·1 N	1·5 E
25 ...	12·1 N	5·5 W	14·7 N	6·0 W	4·9 N	5·9 W	10·2 N	7·5 W	3·9 N	7·3 W	1·3 S	18·4 W	3·4 S	15·8 W	4·3 N	5·1 W	8·4 S	0·3 W	7·3 N	4·5 W	6·3 N	4·2 E	5·5 N	5·7 E
26 ...	8·9 N	4·6 W	8·1 N	4·6 W	1·2 N	5·5 W	11·2 N	8·1 W	3·5 N	6·0 W	1·1 N	12·7 W	5·0 S	12·1 W	8·0 N	7·4 W	4·9 S	2·2 E	6·0 N	4·6 W	6·9 N	1·0 E	7·7 N	4·7 E
27 ...	9·0 N	4·3 W	5·3 N	4·2 W	2·6 N	8·0 W	11·6 N	7·0 W	0·8 S	6·1 W	1·7 S	10·0 W	6·8 S	6·0 W	2·2 N	7·7 W	5·9 S	0·4 W	7·5 N	3·7 W	5·5 N	3·3 E	5·1 N	1·8 E
28 ...	7·4 N	2·8 W	9·6 N	4·5 W	3·5 N	5·3 W	9·6 S	6·2 W	2·9 S	5·1 W	1·1 S	11·6 W	7·6 S	5·7 W	3·8 S	11·1 W	0·3 N	3·0 W	6·0 N	0·9 E	6·9 N	3·0 E	5·7 N	0·5 E
29 ...	5·7 N	3·0 W			7·5 N	7·3 W	2·1 N	4·8 W	4·0 S	5·6 W	1·2 S	13·8 W	7·0 S	13·6 W	2·3 S	12·4 W	1·9 N	1·8 W	8·2 N	1·2 W	7·6 N	4·9 E	5·1 N	0·3 W
30 ...	3·3 N	3·9 W			8·4 N	6·8 W	7·6 S	4·3 W	2·7 S	6·9 W	3·7 S	10·8 W	7·5 S	18·0 W	2·0 S	10·6 W	3·2 N	0·9 E	2·6 N	0·1 W	5·3 N	0·9 W	6·0 N	0·0
31 ...	2·9 N	4·2 W			3·6 N	6·3 W			1·7 S	6·8 W			9·5 S	11·3 W	1·3 S	4·2 W			3·1 N	2·8 E			8·0 N	1·7 E
Monthly Mean ...	6·7 N	2·5 W	7·3 N	4·2 W	5·4 N	5·3 W	3·7 N	6·1 W	1·3 N	7·0 W	1·8 S	10·7 W	6·6 S	9·7 W	3·5 S	13·7 W	1·5 S	4·3 W	2·7 N	0·8 W	5·9 N	1·7 E	5·8 N	2·4 E
Annual Variation ...	4·6 N	2·5 E	5·2 N	0·8 E	3·3 N	0·3 W	1·6 N	1·1 W	0·8 S	2·0 W	3·9 S	5·7 W	8·7 S	4·7 W	5·6 S	8·7 W	3·6 S	0·7 E	0·6 N	4·2 E	3·8 N	6·7 E	3·7 N	7·4 E

The Velocities of the Mean Components for the year are 2·1 N. and 5·0 W.

Velocity of Wind, 1897.

Robins on Beckley's Anemograph.

Table VIII.—*Mean Velocity of the Wind, in miles per hour, without regard to the direction from which it blew, for each Day of Bombay Civil Time: also the Mean Monthly Velocity, and its Variation from the Mean of the year.*

1897. Date.	January.	February.	March.	April.	May.	June.	July.	August.	September	October.	November	December
	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.
1	11·0	12·1	13·7	9·7	7·9	**7·2**	10·7	16·2	6·4	9·7	10·6	7·2
2	9·8	14·2	**14·2**	9·7	6·7	7·7	10·2	12·4	8·4	6·0	7·9	8·4
3	7·7	11·8	10·2	9·8	7·7	9·0	10·8	16·5	8·0	6·1	11·0	7·5
4	9·5	**5·4**	8·5	6·7	**6·0**	11·8	10·5	21·4	11·2	8·5	8·7	7·1
5	8·9	7·5	8·2	7·8	7·4	8·4	11·0	22·1	12·1	14·0	11·6	10·0
6	7·7	11·0	7·7	6·9	8·9	10·1	16·5	**26·1**	12·1	**15·1**	11·6	12·6
7	7·6	9·8	**5·7**	8·7	8·6	9·0	12·2	26·0	12·0	8·2	10·1	12·3
8	7·1	13·2	6·7	11·8	10·8	12·5	15·4	21·8	11·0	**5·5**	11·0	7·7
9	**5·5**	11·9	7·9	9·3	10·3	**24·5**	13·0	17·6	11·0	9·0	11·6	7·7
10	8·7	10·5	12·9	7·6	12·2	13·5	21·1	19·8	13·7	6·6	8·4	8·3
11	11·0	11·2	13·2	10·7	**13·7**	15·2	**23·2**	13·7	14·5	8·2	9·3	**5·4**
12	10·0	12·8	8·2	12·3	8·7	12·5	18·0	17·5	12·0	7·7	8·7	10·0
13	7·0	8·2	7·9	13·0	8·7	12·0	18·1	15·5	14·2	6·3	8·2	11·3
14	11·0	5·8	6·0	10·7	10·4	11·4	18·7	16·1	**15·5**	8·3	8·4	11·4
15	12·3	7·8	6·8	7·4	7·5	16·5	17·6	17·4	12·5	7·7	8·7	11·9
16	11·9	13·1	8·4	9·7	7·2	16·3	13·5	15·1	8·9	9·8	9·9	**14·9**
17	6·9	5·8	11·5	9·4	8·2	19·3	19·1	11·7	6·8	9·4	9·9	13·4
18	7·6	6·4	13·6	6·8	7·4	11·5	16·0	10·9	**6·1**	10·0	9·7	10·7
19	11·1	9·5	10·0	9·1	7·5	15·5	13·5	12·3	8·1	11·4	9·3	9·3
20	12·9	8·6	6·2	7·8	7·0	14·1	11·4	14·5	12·0	8·4	8·5	12·7
21	11·2	8·8	7·5	12·0	7·0	15·8	12·0	14·8	9·7	7·2	10·4	13·1
22	9·7	10·3	5·9	7·9	9·0	21·1	**8·7**	16·0	6·5	8·4	**7·0**	10·8
23	8·0	9·3	6·3	12·1	8·8	19·6	10·7	11·3	11·0	6·3	9·5	8·1
24	12·6	14·3	8·6	12·7	8·2	19·0	11·4	8·9	6·6	6·7	8·7	9·5
25	**13·8**	**17·3**	9·4	13·1	8·8	15·6	16·7	8·6	11·6	9·5	10·6	12·2
26	10·5	10·2	9·2	**15·3**	8·4	13·0	13·3	11·2	8·9	8·2	9·0	12·3
27	10·4	8·0	8·5	14·4	8·2	10·4	9·3	8·6	8·2	9·4	9·7	8·7
28	8·9	11·5	6·5	12·1	8·0	11·8	10·7	12·1	6·2	8·2	10·0	8·1
29	8·3		11·0	**6·3**	10·0	14·1	15·7	12·8	7·4	9·7	**12·1**	7·8
30	5·8		11·5	11·5	10·1	12·3	19·5	11·0	7·1	5·5	8·3	10·0
31	8·6		9·1		7·8		15·0	**7·1**		8·6		11·7
Monthly Mean	9·5	10·2	9·1	10·1	8·6	13·7	14·3	**15·1**	10·0	**8·5**	9·6	10·1
Annual Variation	−1·2	−0·5	−1·6	−0·6	−2·1	+3·0	+3·6	+4·4	−0·7	−2·2	−1·1	−0·6

	Miles.
The Mean Velocity for June to August	14·4
The Mean Velocity for September to May	9·5
The Mean Velocity for the year	10·7
The greatest monthly mean (that of August)	15·1
The least monthly mean (that of October)	8·5
Difference = ...	6·6

The greatest Mean daily Velocity of Wind in the year (that of 6th August) was... ...	26·1
The least do. do. do. (that of 4th February) was ...	5·4
Difference = ...	20·7

Velocity of Wind, March 1897 to February 1898.

Dines' Anemograph.

Table VIIIa.—*Mean Velocity of the Wind, in miles per hour, for each Day of Bombay Civil Time; also the Mean Monthly Velocity, and its Variation from the Mean of the year.*

1897-98.	MONTH.											
Date.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	January.	February
	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.
1	9·7	7·0	5·7	**4·9**	7·1	11·2	4·0	6·5	7·1	4·7	6·6	6·4
2	**10·3**	7·0	4·6	5·4	6·7	8·3	5·4	3·6	5·2	5·5	7·2	7·6
3	7·4	6·7	5·5	6·4	7·0	10·6	5·1	4·0	7·6	5·0	7·5	7·0
4	6·0	**4·1**	**4·0**	8·6	6·8	14·4	7·0	5·8	5·9	4·7	8·4	4·5
5	5·7	5·2	5·1	5·7	7·7	14·6	8·0	10·5	7·5	6·7	7·7	4·0
6	5·1	4·8	6·0	6·9	11·3	17·0	7·7	**10·8**	7·7	8·6	7·2	5·8
7	**4·0**	6·2	5·8	6·2	8·8	**17·3**	7·5	5·7	6·5	8·2	5·7	6·0
8	4·5	8·4	8·2	9·0	10·6	14·2	7·2	**3·4**	7·3	5·2	5·0	4·5
9	5·5	6·6	7·4	**17·8**	8·8	11·6	7·4	6·2	7·5	5·3	5·2	13·1
10	9·2	5·3	8·8	9·8	15·8	12·7	9·6	4·2	5·6	5·5	7·2	**13·4**
11	9·4	7·6	**10·0**	10·3	**15·9**	8·8	9·2	5·5	6·2	**3·4**	6·8	5·9
12	5·7	8·9	5·9	8·8	12·5	11·6	8·6	5·1	5·7	6·7	7·0	9·3
13	5·6	9·3	6·0	8·4	12·3	9·9	10·2	4·2	5·5	7·6	7·2	6·3
14	4·3	7·7	7·7	7·6	12·6	10·5	**11·0**	5·6	5·5	7·8	**8·5**	5·9
15	4·8	5·2	5·1	11·5	11·6	11·5	8·7	5·0	6·0	8·2	8·4	7·2
16	*	7·1	4·7	11·0	9·5	9·8	5·9	6·7	7·0	**9·9**	7·3	8·4
17	8·4	7·1	5·2	13·3	12·9	8·0	4·3	6·5	6·7	9·1	7·0	8·8
18	9·7	5·2	5·0	8·2	10·8	7·3	4·1	7·0	6·5	7·3	5·5	8·4
19	7·2	6·8	5·3	10·3	9·2	8·4	5·5	8·0	6·5	6·2	6·6	10·4
20	4·5	5·7	4·7	9·2	8·3	10·1	8·0	5·8	5·7	8·7	6·5	7·1
21	5·6	8·9	4·9	10·6	8·6	9·8	6·5	5·1	7·0	8·7	5·9	7·6
22	4·4	5·7	6·2	13·9	**5·8**	10·7	4·4	5·8	**4·7**	7·1	4·0	9·5
23	4·5	8·9	6·2	12·7	7·1	7·2	7·5	4·6	6·5	5·1	5·2	4·5
24	6·2	9·2	5·7	12·8	7·5	5·6	4·3	4·7	6·0	6·5	5·2	4·9
25	6·6	9·6	6·3	10·4	11·0	5·7	8·1	6·5	7·1	8·3	8·0	5·9
26	6·6	**11·3**	6·2	8·6	8·6	7·7	6·2	5·9	6·4	8·5	6·2	5·9
27	6·2	10·6	5·9	6·7	6·5	5·5	5·5	6·7	6·6	6·1	5·4	**3·3**
28	4·5	8·9	5·7	7·5	7·5	7·7	**3·9**	5·7	6·7	5·7	5·8	3·6
29	8·0	4·7	7·3	9·3	10·4	8·1	5·0	6·9	**8·1**	5·2	5·0	
30	8·3	8·1	7·2	8·3	12·7	6·8	4·7	3·9	5·7	7·0	4·4	
31	6·5		5·2		10·8	**4·4**		5·9		8·0	**3·5**	
Monthly Mean.	6·5	7·3	6·1	9·3	9·8	**9·9**	6·7	**5·9**	6·5	6·8	6·4	7·0
Annual Variation... ...	−0·8	0·0	−1·2	+2·0	+2·5	+2·6	−0·6	−1·4	−0·8	−0·5	−0·9	−0·3

	Miles.
The mean Velocity for June to August	... 9·7
The mean Velocity for September to May	... 6·6
The mean Velocity for the year	... 7·3
The greatest monthly mean (that of August)	... 9·9
The least monthly mean (that of October)	... 5·9
Difference =	... 4·0
The greatest mean daily Velocity of Wind in the year (that of 9th June) was ...	... 17·8
The least do. do. do. (that of 27th February) was	... 3·3
Difference =	... 14·5

*Not entered as tabulations of 7 hours in the day were lost.

Aggregate and Mean Velocities and Relative Frequency of Different Winds, 1897.

TABLE IX.—*Showing, for the year 1897, the sums of the Velocities, and the Mean Velocities, in miles per hour, of the Winds which blew in each Month, from each of the sixteen Principal Directions: and also the number of hourly Observations which those sums comprise; the latter numbers indicating the Relative Frequency of the same Wind (as to direction) in the several Months, and of different Winds during the same Month.*

1879.	N.			N.N.E.			N.E.			E.N.E.			E.			E.S.E.			S.E.			S.S.E.		
Month.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.
	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.
January ...	959	123	7·8	377	57	6·6	234	37	6·3	478	60	8·0	85	10	8·5	99	13	7·6	74	9	8·2	8	1	8·0
February ...	1,038	121	8·6	241	34	7·1	168	27	6·2	167	20	8·3	53	11	4.8	50	7	7·1	13	2	6·5	47	8	5·9
March ...	486	72	6·7	260	41	6·3	99	20	4·9	89	16	5·6	17	4	4·2	8	2	4·0	50	7	7·1	36	7	5·1
April ...	401	64	6·3	164	32	5·1	62	12	5·2	14	2	7·0	9	2	4·5	9	2	4·5	0	0	0·0	102	9	11·3
May ...	57	11	5·2	10	3	3·3	4	1	4·0	17	3	5·7	11	2	5·5	0	0	0·0	5	1	5·0	117	12	9·7
June... ...	6	2	3·0	0	0	0·0	70	5	14·0	73	4	18·2	88	6	14·7	29	3	9·7	108	7	15·4	260	13	20·0
July ...	0	0	0·0	0	0	0·0	6	1	6·0	0	0	0·0	23	2	11·5	0	0	0·0	96	8	12·0	691	46	15·0
August ...	15	2	7·5	13	2	6·5	14	3	4·7	0	0	0·0	7	1	7·0	0	0	0·0	38	5	7·6	0	0	0·0
September ...	144	21	6·9	43	5	8·6	129	18	7·2	195	23	8·5	104	12	8·7	128	13	9·8	203	24	8·5	628	58	10·8
October ...	520	88	5·9	212	36	5·9	324	55	5·9	414	66	6·3	364	47	7·7	126	12	10·5	291	32	9·1	374	33	11·3
November ...	533	78	6·8	285	46	6·2	590	72	8·2	1,949	192	10·2	531	55	9·7	59	7	8·4	0	0	0·0	0	0	0·0
December ...	638	95	6·7	150	24	6·2	569	63	9·0	2,432	229	10·6	575	55	10·5	136	16	8·5	10	1	10·0	0	0	0·0
Year ...	4,797	677	7·1	1,755	280	6·3	2,269	314	7·2	5,828	615	9·5	1,867	207	9·0	644	75	8·6	888	96	9·2	2,263	187	12·1

1897.	S.			S.S.W.			S.W.			W.S.W.			W.			W.N.W.			N.W.			N.N.W.			No. of Observations.		No. of hours.
Month.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Calm.	Variable.	Record lost.
	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.			
January ...	0	0	0·0	0	0	0·0	3	1	3·0	82	10	8·2	174	24	7·2	475	58	8·2	2,005	170	11·8	1,985	171	11·6	0	0	0
February ...	9	2	4·5	21	4	5·2	5	1	5·0	24	4	6·0	130	22	5·9	764	75	10·2	2,612	222	11·8	1,535	111	13·8	1	0	0
March ...	13	3	4·3	2	1	2·0	14	4	3·5	27	4	6·7	363	46	7·9	1,950	223	8·7	2,505	232	10·8	833	61	13·7	1	0	0
April ...	297	23	12·9	381	46	8·3	124	17	7·3	308	37	8·3	770	99	7·8	1,344	124	10·8	2,412	168	14·4	853	80	10·7	2	1	0
May ...	86	9	9·6	224	29	7·7	106	20	5·3	719	84	8·6	1,959	241	8·1	1,803	198	9·1	1,092	100	10·9	198	29	6·8	1	0	0
June ...	457	23	19·9	287	23	12·5	240	28	8·6	2,312	160	14·4	4,164	303	13·7	1,402	110	12·7	298	29	10·3	11	1	11·0	0	3	0
July ...	1,183	68	17·4	665	61	10·9	1,282	116	11·1	4,097	259	15·8	2,430	168	14·5	165	13	12·7	14	2	7·0	0	0	0·0	0	0	0
August ...	11	1	11·0	93	9	10·3	930	78	11·9	5,767	365	15·8	3,720	217	17·1	270	30	9·0	293	26	11·3	48	5	9·6	0	0	0
September ...	536	44	12·2	664	58	11·4	339	40	8·5	956	83	11·5	1,294	139	9·3	672	71	9·5	886	76	11·7	266	34	7·8	1	0	0
October ...	357	35	10·2	122	14	8·7	115	16	7·2	208	44	4·7	104	13	8·0	315	34	9·3	1,448	129	11·2	1,038	90	11·5	0	0	0
November ...	0	0	0·0	0	0	0·0	0	0	0·0	0	0	0·0	57	8	7·1	259	26	10·0	1,215	113	10·8	1,447	123	11·8	0	0	0
December ...	0	0	0·0	0	0	0·0	0	0	0·0	0	0	0·0	135	17	7·9	294	38	7·7	818	89	9·2	1,736	117	14·8	0	0	0
Year ...	2,949	208	14·2	2,459	245	10·0	3,158	321	9·8	14,500	1,050	13·8	15,300	1,297	11·8	9,713	1,000	9·7	15,598	1,356	11·5	9,950	822	12·1	6	4	0

Temperature of the Ground, 1897.

TABLE X.—*Showing, for each Month, the Mean Temperature of the Ground, and its Annual Variation, at the respective depths of 1, 9, 20, 60 and 132 inches below the surface.*

DEPTH.	1 INCH.		9 INCHES.		20 INCHES.		60 INCHES.		132 INCHES.	
Month.	Mean Temperature.	Excess over the yearly Mean.	Mean Temperature.	Excess over the yearly Mean.	Mean Temperature.	Excess over the yearly Mean.	Mean Temperature.	Excess over the yearly Mean.	Mean Temperature.	Excess over the yearly Mean.
	°	°	°	°	°	°	°	°	°	°
January ...	75·9	—5·4	77·2	—4·4	80·9	—3·0	83·9	—1·0	83·7	—0·4
February ...	76·3	—5·0	76·9	—4·7	79·7	—4·2	82·7	—2·2	83·1	—1·0
March	79·0	—2·3	79·0	—2·6	80·8	—3·1	82·6	—2·3	82·9	—1·2
April	84·0	+2·7	83·1	+1·5	83·6	—0·3	83·5	—1·4	83·1	—1·0
May	86·6	+5·3	85·7	+4·1	86·5	+2·6	85·5	+0·6	83·8	—0·3
June	85·7	+4·4	85·7	+4·1	87·5	+3·6	86·9	+2·0	84·7	+0·6
July	82·6	+1·3	83·7	+2·1	86·4	+2·5	87·0	+2·1	85·3	+1·2
August... ...	82·4	+1·1	82·9	+1·3	85·0	+1·1	85·9	+1·0	85·3	+1·2
September ...	82·7	+1·4	82·9	+1·3	85·0	+1·1	85·4	+0·5	84·8	+0·7
October ...	83·3	+2·0	83·1	+1·5	85·1	+1·2	85·5	+0·6	84·5	+0·4
November ...	80·3	—1·0	80·8	—0·8	84·1	+0·2	85·2	+0·3	84·1	0·0
December ...	77·3	—4·0	78·4	—3·2	82·1	—1·8	84·4	—0·5	83·8	—0·3
Year ...	81·3		81·6		83·9		84·9		84·1	

Extent of Cloudy Sky, 1897.

TBLE XI.—*Means of Estimations made at 6, 10, 14, 16 and 22 hours daily, the whole Sky being reckoned as 10.*

1897.	MONTH.											
Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1	0·6	1·8		4·4		8·0	**3·4**	8·8	8.2	7·0		
2				3·0	0·4	4·6	4·4	9·6	9·0	7·8		0·6
3	4·4			0·2	0·8	4·0	5·8	8·2	8·0	**9·6**		
4				2·0	4·2	**2·2**	3·6	**10·0**	7·6	7·4		
5				1·4	2·6	4·4	8·0	10·0	7·6	5·2		
6	0·4			0·4	3·0	8·0	**10·0**	9·8	8·0	6·0		
7			0·8	1·2	3·2	8·6	10·0	10·0	7·6	1·8	0·2	1·6
8					1·4	6·0	9·4	10·0	8·8	5·8		1·6
9	1·2		1·2	0·2	3·8	6·2	8·4	10·0	**10·0**	6·4		2·2
10		0·2	2·0	2·6	2·6	5·6	9·4	10·0	9·2	9·4	1·0	0·4
11		**5·6**		1·8	2·2	**10·0**	10·0	9·8	10·0	6·6	**2·2**	
12	0·4			2·0	2·4	10·0	8·6	10·0	4·6	2·6		
13	1.0			1·4	2·6	10·0	9·8	9·2	4·0	4·6		
14	5·4	0·2		1·0	2·4	10·0	7·6	10·0	4·4	4·2		
15	6·6	2·8		5·2	5·0	7·6	10·0	10·0	5·6	1·4		**3·6**
16	7·0	0·6		**8·4**	3·8	8·6	10·0	9·2	5·2	2·2		0·4
17	2·0	1·4	0·4	4·8	3·6	9·0	10·0	7·8	4·6	0·8		
18	**7·8**		4·8	5·8	1·6	9·4	10·0	5·4	**2·4**	0·4		0·4
19	2·0		**5·0**	3·8	6·2	9·8	9·2	6·4	6·6	0·6		2·0
20	2·2			2·8	5·4	7·2	9·8	8·0	9·8			0·2
21	1·4		1·0	1·4	6·2	9·6	8·4	9·0	9·4	1·6		
22	2·0		2·6	1·6	3·4	10·0	9·8	10·0	6·6	8·4		
23	0·6		3·8	0·2	3·6	8·6	10·0	8·8	10·0	2·6		
24	1·2	5·0	1·2		1·6	10·0	9·2	7·8	9·2	4·2		
25		4·0			6·2	6·2	10·0	8·2	9·4	2·6		
26	1·8			2·0	**9·4**	6·4	9·4	9·0	8·8	1·0		
27	6·0		2·6		2·4	8·4	8·0	9·4	6·4	2·8		
28	2·0		2·6	0·8	5·2	4·6	8·0	9·4	7·6	0·2		
29	4·4		0·6	0·2	1·2	4·0	9·2	7·8	9·4			0·6
30					1·4	6·4	10·0	4·4	8·0			0·2
31	1·2		2·2		3·0		9·6	**3·2**				
Monthly Mean.	2·0	0·8	1·0	2·0	3·3	7·4	**8·7**	8·7	7·5	3·7	**0·1**	0·4
Annual Variation. ...	—1·8	—3·0	—2·8	—1·8	—0·5	+3·6	+4·9	+4·9	+3·7	—0·1	—3·7	—3·4

For the days which have no entry, 0·0 is to be understood.

Mean of the months from January to April, November and December ... ... 1·0

Mean of the months from May to October ... ... 6·5

Mean for the year ... ... 3·8

Rainfall, 1897.

TABLE XII.—*Total Fall of Rain (in inches) as measured by Newman's Gauge, placed 4½ feet above the ground.*

1897. Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	In.					In.	In.	In.	In.	In.		
1	...	...	...	...	...	...	...	0·35	...	0·50	...	...
2	...	...	...	...	...	...	...	0·02	0·12	**0·86**	...	...
3	...	...	...	...	...	...	...	0·08	...	0·60	...	...
4	...	...	...	...	...	...	0·05	0·65	0·51	0·30	...	...
5	...	...	...	...	...	...	0·13	0·11	0·51	0·15	...	...
6	...	...	...	...	...	1·09	0·75	1·13	0·17	0·09	...	...
7	...	...	...	...	...	0·04	3·89	1·06	0·75	...	...	...
8	...	...	...	...	...	1·34	0·32	0·22	0·55	...	...	...
9	...	...	...	...	...	...	0·02	0·62	0·36	...	...	...
10	...	...	...	...	...	0·02	0·79	**2·73**	1·71	...	...	...
11	...	...	...	...	...	1·56	2·03	0·53	**4·74**	...	...	...
12	...	...	...	...	...	...	0·04	0·27	0·09	0·01	...	...
13	...	...	...	...	...	**3·23**	0·81	0·11	0·38	...	...	...
14	...	...	...	...	...	0·08	0·24	1·87	...	...	...	...
15	...	0·01	...	...	...	0·18	1·96	2·09	0·45	...	...	...
16	...	...	...	...	...	0·06	**4·92**	0·29	0·57	...	...	...
17	...	...	...	...	...	0·11	1·10	0·08	...	...	...	...
18	...	...	...	...	...	2·42	1·22	0·27	...	...	...	...
19	...	...	...	...	...	0·83	0·18	0·07	0·04	...	...	...
20	...	...	...	...	...	0·02	1·73	0·61	2·33	...	...	...
21	...	...	...	...	...	0·99	0·34	0·05	0·01	...	...	...
22	...	...	...	...	...	0·97	1·76	0·22	0·30	...	...	...
23	...	...	...	...	...	0·12	2·12	0·02	0·66	...	...	...
24	...	...	...	...	...	0·42	1·39	0·06	0·91	...	...	...
25	...	...	...	...	...	0·10	1·53	0·15	4·55	...	...	...
26	...	...	...	...	...	0·19	0·85	...	0·37	...	...	...
27	...	...	...	...	...	...	0·25	0·11	...	...	...	...
28	...	...	...	...	...	...	0·47	0·03	0·41	...	...	...
29	...	...	...	...	...	0·07	0·77	0·02	...	...	...	...
30	...	...	...	...	...	0·56	0·45	...	0·11	...	...	...
31	...	...	...	...	...	...	0·08	...	...	...	...	...
Monthly Total.	0·01	...	...	...	...	14·40	**30·19**	13·82	20·60	2·51	...	...
Number of Rainy Days ...	1	...	...	...	...	21	**28**	28	23	7	...	...

Total fall of rain in the year ... ... 81·53 inches.
Total number of rainy days in the year 108
The greatest daily fall of rain in the year (that of 16th July) was ... ... 4·92 inches.
No rain fell in the months of February, March, April, May, November and December, nor on any of the days left blank in the above table.

Table XIII.—Five-day Means, 1897.

Number of Five-day Period.	Baro-metric Pressure.	Tempera-ture of the Air.	Pressure of Vapour.	Additional Capacity of the Air.	*Rainfall.	North or South Component of Wind.	East or West Component of Wind.	Number of Five-day Period.	Baro-metric Pressure.	Tempera-ture of the Air.	Pressure of Vapour.	Additional Capacity of the Air.	*Rainfall.	North or South Component of Wind.	East or West Component of Wind.
	In.	°	In.	In.	In.	Miles.	Miles.		In.	°	In.	In.	In.	Miles.	Miles.
1	29·941	74·5	0·637	0·225		7·2 N.	1·5 W.	38	29·579	81·1	0·929	0·135	5·11	**11·4 S.**	0·3 W.
2	·925	77·8	·704	·255		4·1 N.	0·4 W.	39	**·570**	82·2	·933	·167	3·91	10·0 S.	14·4 W.
3	·957	73·5	·606	·222	0·01	7·3 N.	2·9 W.	40	·663	80·3	·914	·123	**9·38**	3·4 S.	14·6 W.
4	**·976**	**70·0**	**·471**	·265		6·1 N.	2·0 W.	41	·656	79·3	·911	**·090**	7·34	5·5 S.	6·0 W.
5	·970	73·1	·596	·243		9·3 N.	4·4 W.	42	·598	80·3	·927	·107	3·87	6·0 S.	10·6 W.
6	·911	72·8	·543	·269		6·9 N.	3·7 W.	43	·663	81·9	·926	·163	0·98	6·9 S.	14·0 W.
7	·919	72 8	·552	·257		6·7 N.	2·9 W.	44	·599	81·0	·918	·141	3·17	4·3 S.	**22·7 W.**
8	·925	74·5	·610	·247		7·6 N.	3·8 W.	45	·620	80·3	·920	·115	4·26	4·2 S.	15·9 W.
9	·896	73·0	·558	·259		6 4 N.	3·5 W.	46	·669	80·5	·913	·130	4·60	5·8 S.	12·6 W.
10	·862	75·5	·614	·271		5·8 N.	3·4 W.	47	·734	80·9	·901	·156	0·97	5·1 S.	12·1 W.
11	·920	75·0	·653	·220		7·2 N.	6·1 W.	48	·667	81·8	·887	·200	0·35	2·3 N.	8·0 W.
12	·907	73·6	·579	·255		**9·9 N.**	4·8 W.	49	·768	81·8	·860	·228	0·14	1·3 S.	7·7 W.
13	·866	76·8	·666	·261		7·5 N.	5·0 W.	50	·789	81·6	·895	·183	1·94	2·5 S.	10·3 W.
14	·898	75·6	·646	·243		5·7 N.	4·4 W.	51	·726	80·0	·878	·149	7·45	2·1 N.	8·7 W.
15	·894	76·2	·674	·235		3·5 N.	4·8 W.	52	·760	81·2	·902	·164	1·40	9·0 S.	1·8 W.
16	·836	77·8	·706	·251		6·1 N.	5·9 W.	53	·731	81·6	·907	·176	2·68	4·4 N.	2·9 W.
17	·832	78·1	·739	·225		3·2 N.	5·2 W.	54	·755	80·4	·919	·121	6·49	4·6 S.	1·0 E.
18	·855	78·3	·729	·244		5·1 N.	6·7 W.	55	·805	81·3	·920	·149	1·88	2·1 N.	0·7 W.
19	·844	78·9	·741	·252		3·4 N.	6·9 W.	56	·801	80·8	·892	·164	1·14	6·7 S.	0·7 E.
20	·815	81·6	·811	·273		1·2 N.	4·8 W.	57	·856	82·2	·896	·209	0·01	4·2 N	0·2 W.
21	·813	82·7	·824	·299		7·9 N.	6·3 W.	58	·801	82·4	·850	·261		5·2 N.	1·0 W.
22	·861	83·3	·886	·256		3·3 S.	5·4 W.	59	·835	80·1	·749	·283		4·9 N.	1·5 W.
23	·830	82·5	·863	·251		7·6 N.	7·1 W.	60	·875	81·6	·881	·198		3·9 N.	3·7 W.
24	·765	85·0	·876	·331		5·4 N.	6·1 W.	61	·916	80·7	·756	·299		5·2 N.	0·9 E.
25	·762	83·4	·859	·287		0·4 N.	6·4 W.	62	·908	78·9	·701	·295		6·4 N.	1·2 E.
26	·788	84·3	·867	·312		3·5 N.	8·6 W.	63	·867	78·9	·690	·303		5·6 N.	1·6 E.
27	·801	84·1	·881	·291		4·1 N.	7·9 W.	64	·878	78·5	·673	·308		6·3 N.	0·6 E.
28	·778	84·9	·898	·303		0·5 S.	6·4 W.	65	·914	76·8	·617	·313		6·1 N.	1·1 E.
29	·760	84·9	·911	·290		2·4 N.	6·9 W.	66	·923	77·2	·616	·326		4·6 N.	3·1 E.
30	·758	86·0	·960	·286		1·4 S.	5·9 W.	67	·883	76·4	·626	·291		5·5 N.	2·5 E.
31	·728	**86·4**	·928	·336		0·9 N.	7·9 W.	68	·942	76·4	·655	·263		4·1 N.	2·8 E.
32	·624	86·3	·976	·283	2·47	4·4 S.	2·3 W.	69	·942	75·2	·597	·284		3·5 N.	2·1 E.
33	·693	85·2	**·978**	·235	4·89	0·3 S.	9·8 W.	70	·939	75·1	·571	·306		8·7 N.	1·6 E.
34	·601	84·4	·974	·209	3·60	0·0	14·0 W.	71	·951	74·4	·511	**·350**		7·6 N.	**3·7 E.**
35	·596	83·6	·950	·203	2·52	5·5 S.	16·7 W.	72	·971	74·3	·570	·287		5·8 N.	3·4 E.
36	·747	84·5	·919	·266	0·36	0·8 S.	12·7 W.	73	·976	73·7	·576	·261		6·0 N.	0·7 E.
37	·726	84·7	·906	·289	0·61	1·9 S.	10·2 W.								

* Five-day sums, *not means*.

TABLES OF RESULTS

OF

ABSOLUTE MAGNETICAL OBSERVATIONS,

1897.

B 761—1

Absolute Magnetical Observations.—Table I.

Observations of Vibration and Deflection, taken with the Kew Unifilar Magnetometer (No. 23, by Elliott Brothers), for the determination of Absolute Horizontal Force.

1897.

1897. Date.	Civil Time, Mean.	Magnet N. 23 *a*. Time of one Vibration	Effect of 90° Torsion.	Temperature.	Rate of Chronometer.	Corresponding Mean Reading of L. H. F. Magnetometer. Scale Reading.	Thermometer.	Angle of Deflection of Magnet N. 23 *c* by N. 23 *a* at Distance. 0·8 foot.	1·0 foot.	Temperature.	Corresponding Mean Reading of L. H. F. Magnetometer. Scale Reading.	Thermometer.	Observer.	Calculated Results in English Units. Values of m.	Values of X. From Deflections at distance. 0·8 foot ($X_{0·8}$)	1·0 foot ($X_{1·0}$)	Difference. $X_{0·8} - X_{1·0}$	Mean. $\frac{X_{0·8}+X_{1·0}}{2}$	Monthly Mean Values of X.	Monthly Mean Values of X in Metrical Units.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
	h. m.	s.	Sc. div.	°	s.		°	° ′ ″	° ′ ″	°		°								
January 6	12 5	2·8452	0·87	87·9	−13·8	16·25	82·8	17 21 22	8 49 40	88·3	15·85	83·6	V.G.G.	·63440	8·1300	8·1270	+·0030	8·1285		
„ „	15 21	2·8468	0·85	86·4	„	14·90	85·4	17 22 12	8 50 2	88·6	15·10	85·4	V.G.G.	·63441	8·1206	8·1180	+·0026	8·1193		
„ 13	12 2	2·8459	0·87	83·6	−12·7	15·91	80·0	17 23 44	8 50 37	82·9	15·90	80·3	N.	·63435	8·1204	8·1191	+·0013	8·1197		
„ „	15 19	2·8455	0·85	82·9	„	15·80	80·7	17 23 35	8 50 32	83·6	15·86	80·6	N.	·63440	8·1208	8·1197	+·0011	8·1202		
„ 20	12 10	2·8412	0·84	76·9	−9·9	17·69	73·7	17 24 25	8 50 51	77·0	17·50	74·6	D.	·63467	8·1313	8·1307	+·0006	8·1310	8·1243	3·7460
„ „	15 26	2·8422	0·82	76·5	„	16·73	76·9	17 24 30	8 51 0	77·9	16·95	76·0	D.	·63461	8·1270	8·1257	+·0013	8·1263		
„ 27	12 4	2·8446	0·75	82·4	−11·9	16·80	78·2	17 23 5	8 50 7	82·0	16·73	78·8	N.	·63425	8·1266	8·1268	−·0002	8·1267		
„ „	15 18	2·8451	0·79	81·2	„	16·19	80·3	17 23 4	8 50 7	83·8	16·30	80·1	N.	·63422	8·1225	8·1225	·0000	8·1225		
February 3	12 8	2·8429	0·75	81·0	−12·3	17·74	76·7	17 22 15	8 49 51	80·6	17·52	77·5	D.	·63419	8·1349	8·1337	+·0012	8·1343		
„ „	15 33	2·8466	0·82	79·1	„	16·19	79·8	17 22 42	8 50 10	81·1	16·93	78·9	D.	·63375	8·1203	8·1184	+·0019	8·1193		
„ 10	12 1	2·8451	0·87	83·3	−11·4	16·79	79·2	17 22 50	8 49 58	82·1	16·74	79·8	N.	·63413	8·1266	8·1270	−·0004	8·1268		
„ „	15 30	2·8462	0·82	83·4	„	16·13	80·3	17 22 57	8 50 7	82·8	16·47	80·1	N.	·63415	8·1225	8·1221	+·0004	8·1223	8·1276	3·7475
„ 17	12 5	2·8451	0·81	85·0	−11·7	16·77	79·9	17 21 50	8 49 30	85·1	16·62	80·5	D.	·63413	8·1292	8·1292	·0000	8·1292		
„ „	15 46	2·8445	0·85	83·4	„	15·97	83·2	17 21 52	8 49 35	85·9	16·22	82·3	D.	·63432	8·1285	8·1281	+·0004	8·1283		
„ 24	12 6	2·8431	0·78	81·7	−12·7	17·10	79·4	17 21 54	8 49 37	81·6	17·06	79·8	N.	·63419	8·1352	8·1345	+·0007	8·1348		
„ „	15 19	2·8456	0·82	84·6	„	16·09	81·1	17 22 36	8 49 53	83·4	16·57	80·7	N.	·63434	8·1261	8·1261	·0000	8·1261		
March 3	12 53	2·8439	0·81	84·4	−12·9	16·71	81·0	17 22 12	8 49 45	83·9	16·33	82·4	D.	·63435	8·1319	8·1313	+·0006	8·1316		
„ „	15 33	2·8452	0·85	83·8	„	15·71	83·4	17 22 21	8 49 52	84·7	15·99	83·1	D.	·63432	8·1262	8·1253	+·0009	8·1257		
„ 10	12 8	2·8438	0·78	81·4	−12·7	16·63	79·9	17 23 7	8 50 11	81·5	16·43	80·3	N.	·63428	8·1285	8·1281	+·0004	8·1283		
„ „	15 22	2·8459	0·82	81·0	„	15·39	81·2	17 23 50	8 50 37	82·6	15·74	81·1	N.	·63432	8·1182	8·1173	+·0009	8·1177		
„ 17	12 4	2·8431	0·84	82·3	−13·5	16·76	81·6	17 21 37	8 49 40	82·6	16·60	82·1	D.	·63422	8·1356	8·1335	+·0021	8·1345	8·1264	3·7469
„ „	15 29	2·8444	0·85	81·8	„	16·07	82·5	17 21 45	8 49 37	83·3	16·32	82·7	D.	·63412	8·1302	8·1291	+·0011	8·1296		
„ 24	12 1	2·8452	0·72	83·8	−14·8	16·45	82·1	17 21 34	8 49 30	83·7	16·34	82·6	N.	·63390	8·1302	8·1292	+·0010	8·1297		
„ „	15 14	2·8471	0·78	84·9	„	15·54	83·8	17 22 5	8 49 43	85·0	15·83	83·4	N.	·63391	8·1223	8·1218	+·0005	8·1220		
„ 31	12 5	2·8459	0·83	84·9	−14·9	16·26	82·0	17 22 0	8 49 37	85·0	16·05	82·4	D.	·63393	8·1261	8·1257	+·0004	8·1259		
„ „	15 46	2·8472	0·83	84·3	„	15·28	83·9	17 22 14	8 49 52	86·0	15·47	83·7	D.	·63394	8·1199	8·1188	+·0011	8·1193		

1897. Date.	Civil Time, Mean.	Magnet N. 23 *a*. Time of one Vibration.	Effect of 90° Torsion.	Temperature.	Rate of Chronometer.	Corresponding Mean Reading of L. H. F. Magnetometer. Scale Reading.	Thermometer.	Angle of Deflection of Magnet N. 23 *c* by N. 23 *a* at Distance. 0·8 foot.	1·0 foot.	Temperature.	Corresponding Mean Reading of L. H. F. Magnetometer. Scale Reading.	Thermometer.	Observer.	Calculated Results in English Units. Values of m.	Values of X. From Deflections at distance. 0·8 foot ($X_{0\cdot8}$)	1·0 foot ($X_{1\cdot0}$)	Difference. $X_{0\cdot8}-X_{1\cdot0}$	Mean. $\frac{X_{0\cdot8}+X_{1\cdot0}}{2}$	Monthly Mean Values of X.	Monthly Mean Values of X in Metrical Units.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
	h. m.	s.	Sc. div.	°	s.		°	° ′ ″	° ′ ″	°		°								
April 7	11 57	2·8463	0·66	87·6	−13·7	15·95	83·4	17 21 32	8 49 26	86·6	15·83	84·1	N.	·63412	8·1279	8·1272	+·0007	8·1275		
„ „	15 25	2·8477	0·73	85·8	„	14·97	85·4	17 22 11	8 49 49	87·5	15·25	85·1	N.	·63407	8·1190	8·1178	+·0012	8·1184		
„ 14	12 10	2·8486	0·70	88·6	−15·1	14·94	86·2	17 22 0	8 49 30	89·2	14·76	86·5	N.	·63387	8·1180	8·1186	−·0006	8·1183		
„ „	15 26	2·8487	0·75	88·5	„	14·48	87·6	17 22 5	8 49 40	89·9	14·67	87·1	N.	·63406	8·1163	8·1161	+·0002	8·1162		
„ 21	12 8	2·8490	0·80	89·8	−14·2	14·72	86·3	17 22 7	8 49 37	89·4	14·65	87·0	D.	·63402	8·1171	8·1173	−·0002	8·1172	8·1197	3·7438
„ „	15 40	2·8493	0·77	88·0	„	14·15	88·1	17 22 15	8 49 37	89·7	14·35	87·7	D.	·63391	8·1139	8·1147	−·0008	8·1143		
„ 28	12 7	2·8480	0·78	92·0	−15·2	15·20	88·1	17 20 22	8 48 55	91·6	14·77	88·9	D.	·63390	8·1262	8·1251	+·0011	8·1256		
„ „	15 29	2·8490	0·83	91·7	„	14·41	89·5	17 20 49	8 49 10	92·1	14·40	89·1	D.	·63394	8·1208	8·1197	+·0011	8·1202		
May 5	12 11	2·8470	0·78	89·9	−13·9	15·53	87·3	17 20 12	8 48 42	90·1	15·40	87·7	N.	·63390	8·1294	8·1294	·0000	8·1294		
„ „	15 28	2·8486	0·81	90·6	„	14·73	89·1	17 20 20	8 48 49	90·2	14·97	88·7	N.	·63377	8·1247	8·1244	+·0003	8·1245		
„ 12	12 13	2·8471	0·82	91·7	−14·6	15·52	87·3	17 19 40	8 48 26	91·4	15·39	87·9	D.	·63394	8·1315	8·1315	·0000	8·1315		
„ „	15 34	2·8483	0·81	90·8	„	14·79	89·0	17 19 40	8 48 30	91·7	15·10	88·8	D.	·63381	8·1268	8·1262	+·0006	8·1265		
„ 19	12 10	2·8476	0·87	90·0	−14·7	15·06	87·9	17 20 30	8 49 0	91·1	14·87	88·4	N.	·63394	8·1255	8·1242	+·0013	8·1248	8·1252	3·7464
„ „	15 37	2·8491	0·78	89·6	„	14·29	89·7	17 21 0	8 49 14	91·0	14·51	89·2	N.	·63386	8·1191	8·1180	+·0011	8·1185		
„ 26	12 23	2·8480	0·82	91·8	−14·7	14·89	88·6	17 20 5	8 48 45	91·4	14·73	88·9	D.	·63387	8·1272	8·1264	+·0008	8·1268		
„ „	15 31	2·8491	0·78	89·2	„	14·28	89·1	17 20 27	8 49 2	91·3	14·42	89·0	D.	·63371	8·1206	8·1191	+·0015	8·1198		
June 2	12 20	2·8476	0·68	91·8	−13·9	15·03	89·8	17 19 31	8 48 25	91·8	14·96	90·1	N.	·63387	8·1306	8·1300	+·0006	8·1303		
„ „	15 20	2·8485	0·75	91·5	„	14·43	91·2	17 20 5	8 48 37	90·9	14·67	91·0	N.	·63383	8·1262	8·1264	−·0002	8·1263		
„ 9	12 6	2·8474	0·82	90·7	−15·5	15·42	87·9	17 19 20	8 48 27	91·6	15·39	88·6	D.	·63383	8·1306	8·1291	+·0015	8·1298		
„ „	15 34	2·8486	0·85	90·4	„	14·62	89·0	17 20 7	8 48 48	91·3	15·00	89·1	D.	·63388	8·1242	8·1231	+·0011	8·1236		
„ 16	12 21	2·8471	0·65	90·2	−14·7	15·59	88·3	17 19 1	8 48 11	91·7	15·72	88·7	N.	·63384	8·1326	8·1320	+·0006	8·1323	8·1272	3·7473
„ „	15 28	2·8498	0·67	92·0	„	14·70	89·4	17 19 26	8 48 16	92·6	15·33	89·1	N.	·63371	8·1240	8·1244	−·0004	8·1242		
„ 24	12 27	2·8480	0·65	88·2	−15·4	15·71	85·4	17 20 5	8 48 47	88·4	15·68	85·5	D.	·63349	8·1272	8·1261	+·0011	8·1266		
„ „	15 33	2·8485	0·63	86·0	„	15·32	85·0	17 20 9	8 49 7	87·1	15·54	85·1	D.	·63337	8·1247	8·1214	+·0033	8·1230		
„ 30	12 16	2·8475	0·70	88·9	−15·2	15·80	86·5	17 19 57	8 48 30	88·5	15·66	86·9	N.	·63352	8·1298	8·1302	−·0004	8·1300		
„ „	15 27	2·8488	0·65	90·6	„	15·20	87·5	17 20 4	8 48 41	89·3	15·40	87·3	N.	·63359	8·1262	8·1259	+·0003	8·1260		
July 7	12 23	2·8470	0·68	84·4	−13·7	15·93	83·6	17 20 20	8 48 52	85·4	15·90	83·4	D.	·63329	8·1287	8·1277	+·0010	8·1282		
„ „	15 37	2·8476	0·66	83·8	„	15·58	83·2	17 20 50	8 49 17	85·3	15·75	83·6	D.	·63345	8·1247	8·1225	+·0022	8·1236		
„ 14	12 11	2·8474	0·62	88·9	−15·1	15·98	85·2	17 18 47	8 48 11	89·5	16·01	85·8	N.	·63345	8·1335	8·1320	+·0015	8·1327		
„ „	15 25	2·8472	0·70	89·4	„	15·88	86·4	17 18 31	8 48 5	89·7	16·04	86·2	N.	·63346	8·1352	8·1335	+·0017	8·1343	8·1295	3·7483
„ 21	12 11	2·8474	0·72	86·7	−14·7	16·18	83·3	17 19 17	8 48 27	86·3	16·21	83·4	D.	·63318	8·1326	8·1309	+·0017	8·1317		
„ „	15 25	2·8476	0·69	86·5	„	15·55	84·0	17 19 37	8 48 46	86·8	15·83	83·8	D.	·63340	8·1300	8·1272	+·0028	8·1286		
„ 28	12 11	2·8471	0·57	87·2	−15·6	15·93	84·1	17 19 19	8 48 25	88·0	15·76	84·5	N.	·63333	8·1324	8·1311	+·0013	8·1317		
„ „	15 20	2·8476	0·55	84·3	„	15·36	84·5	17 20 0	8 48 47	88·1	15·51	84·8	N.	·63339	8·1259	8·1244	+·0015	8·1251		

August 4	12	23	2·8473	0·56	86·7	−16·3	15·87	84·4	17	20	42	8	48	57	87·1	15·73	84·7	D.	·63356	8·1268	8·1266	+·0002	8·1267		
„ „	15	40	2·8483	0·58	84·7	„	15·14	84·5	17	21	47	8	49	29	86·6	15·36	84·5	D.	·63364	8·1184	8·1184	·0000	8·1184		
„ 11	12	16	2·8457	0·61	83·0	−16·6	16·14	81·6	17	21	35	8	49	21	83·7	16·11	81·9	N.	·63371	8·1279	8·1281	−·0002	8·1280		
„ „	15	29	2·8477	0·56	85·1	„	15·72	82·1	17	21	55	8	49	42	83·8	15·89	82·0	N.	·63365	8·1229	8·1216	+·0013	8·1222		
„ 18	12	29	2·8482	0·62	86·6	+11·7	15·76	83·7	17	21	7	8	49	20	86·8	15·62	83·9	D.	·63369	8·1253	8·1240	+·0013	8·1246	8·1241	3·7459
„ „	15	45	2·8488	0·57	87·0	„	15·09	84·5	17	21	27	8	49	25	87·6	15·23	84·5	D.	·63386	8·1221	8·1214	+·0007	8·1217		
„ 25	12	35	2·8481	0·55	88·2	+11·8	15·57	84·2	17	21	11	8	49	17	87·2	15·53	84·6	N.	·63391	8·1264	8·1257	+ ·0007	8·1260		
„ „	15	30	2·8482	0·60	87·6	„	15·37	84·9	17	20	53	8	49	11	88·1	15·43	84·9	N.	·63386	8·1261	8·1247	+·0014	8·1254		
September 1	13	38	2·8464	0·68	88·0	+13·4	15·86	85·4	17	20	37	8	48	55	87·6	15·70	85·8	D.	·63404	8·1328	8·1326	+·0002	8·1327		
„ „	15	55	2·8475	0·62	86·1	„	15·31	86·0	17	20	27	8	49	0	87·5	15·51	85·9	D.	·63384	8·1291	8·1276	+·0015	8·1283		
„ 8	12	28	2·8457	0·60	83·4	+13·1	16·17	83·3	17	21	10	8	49	7	84·4	16·11	83·2	N.	·63383	8·1319	8·1324	−·0005	8·1321		
„ „	15	30	2·8485	0·58	86·0	„	15·54	83·6	17	21	5	8	49	8	85·7	15·85	83·6	N.	·63365	8·1253	8·1251	+·0002	8·1252		
„ 15	12	21	2·8482	0·62	87·0	+12·1	15·58	84·1	17	20	40	8	49	16	86·9	15·52	84·6	D.	·63371	8·1274	8·1247	+·0027	8·1260		
„ „	16	12	2·8480	0·59	85·5	„	15·25	85·0	17	20	25	8	49	15	87·9	15·29	85·0	D.	·63369	8·1266	8·1233	+·0033	8·1249	8·1275	3·7474
„ 22	12	34	2·8493	0·56	91·5	+12·5	15·65	85 8	17	19	50	8	48	35	90·7	15·49	86·2	N.	·63367	8·1279	8·1274	+·0005	8·1276		
„ „	15	30	2·8497	0·60	90·4	„	15·13	87·0	17	19	33	8	48	18	92·6	15·26	86·9	N.	·63361	8·1251	8·1255	−·0004	8·1253		
„ 29	12	44	2·8479	0·57	85·0	+13·2	16·17	84·0	17	19	57	8	48	42	86·4	16·08	84·0	D.	·63330	8·1300	8·1291	+·0009	8·1295		
„ „	16	0	2·8488	0·57	84·8	„	15·44	84·0	17	20	35	8	49	15	86·8	15·63	84·1	D.	·63350	8·1244	8·1216	+·0028	8·1230		
October 6	12	29	2·8481	0·55	87·0	+13·1	15·94	84·0	17	20	45	8	48	51	87·6	15·75	84·3	N.	·63359	8·1268	8·1277	−·0009	8·1272		
„ „	15	43	2·8492	0·61	87·1	„	15·38	84·7	17	20	50	8	49	9	88·4	15·47	84·8	N.	·63364	8·1229	8·1218	+·0011	8·1223		
„ 13	12	30	2·8493	0·63	90·5	+12·7	15·42	86·2	17	20	20	8	49	0	90·4	15·18	86·9	D.	·63374	8·1253	8·1234	+·0019	8·1243		
„ „	15	37	2·8497	0·65	88·8	„	14·87	87·2	17	20	40	8	49	5	90·7	14·94	87·1	D.	·63372	8·1212	8·1199	+·0013	8·1205	8·1241	3·7459
„ 20	12	14	2·8483	0·76	86·8	+13·2	15·86	84·0	17	21	14	8	49	6	87·1	15·63	84·6	N.	·63362	8·1244	8·1251	−·0007	8·1247		
„ „	15	30	2·8496	0·68	87·3	„	15·15	85·8	17	21	20	8	49	25	88·3	15·28	85·3	N.	·63368	8·1201	8·1188	+·0013	8·1194		
„ 28	12	3	2·8484	0·70	91·0	+13·0	15·95	85·6	17	19	27	8	48	32	90·8	15·64	86·2	D.	·63369	8·1313	8·1296	+·0017	8·1304		
„ „	15	36	2·8489	0·74	88·8	„	14·84	88·0	17	19	55	8	48	49	91·6	15·16	87·5	D.	·63386	8·1253	8·1233	+·0020	8·1243		
November 3	12	30	2·8477	0·81	86·1	+12·7	15 95	83·4	17	21	33	8	49	25	85·7	15·74	83·8	N.	·63375	8·1257	8·1251	+·0006	8·1254		
„ „	15	33	2·8489	0·78	85·8	„	15·27	84·6	17	21	39	8	49	40	87·3	15·35	84·4	N.	·63375	8·1261	8·1180	+·0021	8·1190		
„ 10	12	16	2·8473	0·77	86·9	0·0	16·18	83·3	17	20	52	8	49	11	87·0	15·97	84·0	D.	·63375	8·1276	8·1264	+·0012	8·1270		
„ „	15	45	2·8487	0·78	85·5	„	15·38	85·0	17	20	42	8	49	7	88·0	15·61	84·9	D.	·63352	8·1221	8·1208	+·0013	8·1214	8·1230	3·7454
„ 17	12	15	2·8480	0·90	87·4	+0·2	16·23	81·9	17	21	0	8	49	22	87·8	16·02	82·5	N.	·63372	8·1246	8·1225	+·0021	8·1235		
„ „	15	28	2·8505	0·88	85·7	„	15·11	84·1	17	22	1	8	49	42	88·5	15·51	83·8	N.	·63358	8·1117	8·1107	+·0010	8·1112		
„ 24	12	43	2·8480	0·90	87·0	+0·4	16·51	82·5	17	19	47	8	48	42	87·2	16·47	83·0	D.	·63336	8·1294	8·1277	+·0017	8·1285		
„ „	15	36	2·8470	0·93	86·4	„	16·49	84·6	17	19	55	8	48	52	89·5	16 42	83·6	D.	·63364	8·1291	8·1266	+·0025	8·1278		
December 1	12	24	2·8465	0·94	86·2	+1·3	16·89	81·3	17	21	7	8	49	17	85·7	16·67	81·7	N.	·63380	8·1292	8·1283	+·0009	8·1287		
„ „	15	37	2·8487	0·96	87·1	„	15·75	83·0	17	20	46	8	49	13	87·2	16·04	82·6	N.	·63361	8·1238	8·1219	+·0019	8·1228		
„ 8	12	21	2·8465	0·70	86·3	+0·8	17·19	80·2	17	20	6	8	48	48	86·6	16·91	81·0	D.	·63362	8·1328	8·1317	+·0011	8·1322		
„ „	15	42	2·8491	0·66	84·3	„	16·11	82·8	17	20	44	8	48	57	87·6	16·50	82·1	D.	·63333	8·1204	8·1204	·0000	8·1204		
„ 15	12	17	2·8491	0·69	85·9	+1·4	16·55	79·6	17	22	27	8	50	3	85·6	16·21	80·6	N.	·63364	8·1171	8·1154	+·0017	8·1162	8·1210	3·7444
„ „	15	26	2·8493	0·62	83·5	„	16·00	82·0	17	22	4	8	49	45	85 2	16·13	81·8	N.	·63342	8·1165	8·1154	+·0011	8·1159		
„ 22	12	45	2·8485	0·75	85·0	+0·8	16·33	80·1	17	21	25	8	49	35	85·5	16·08	80·8	D.	·63343	8·1219	8·1199	+·0020	8·1209		
„ „	15	43	2·8488	0·68	83·1	„	15·66	82·8	17	21	50	8	49	52	85·5	15·90	82·3	D.	·63355	8·1180	8·1154	+·0026	8·1167		
„ 29	12	21	2·8484	0·60	85·1	+0·9	16·58	79·2	17	22	6	8	49	41	85·5	16·51	79·9	N.	·63371	8·1201	8·1197	+·0004	8·1199		
„ „	15	17	2·8499	0·60	85·6	„	15·82	82·2	17	21	42	8	49	39	85·9	16 31	81·5	N.	·63353	8·1173	8·1156	+·0017	8·1164		
The mean value of the Horizontal Force for the year 1897 = 8·1250																									3·7463

Absolute Magnetical Observations.—Table II.

Observations of Absolute Declination.

1897.

1897. Date.	Bombay Civil Time.	Mean Readings. Collimator Magnet. Scale apparently Erect.	Collimator Magnet. Scale apparently Inverted.	Horizontal Circle with Telescope pointed to Scale of Collimator Magnet.	Horizontal Circle with Telescope pointed to Tárdeo Chimney.	Torsion. Mean.	Torsion. Effect of 90°.	Observer.	Corresponding Reading of Declination Magnetograph.	Absolute Easterly Declination corrected for Torsion.	Monthly Mean. Corresponding Reading of Declination Magnetograph.	Monthly Mean. Absolute Easterly Declination.
1	2	3	4	5	6	7	8	9	10	11	12	13
	H. m.	Sc. div.	Sc. div.	° ′ ″	° ′ ″	°	Sc. div.		Sc. div.	° ′ ″	Sc. div.	° ′ ″
JAN. 7	11 20	+1·54	+1·61	17 0 25	196 53 40	0		V G.G.	19·43	0 33 7		
„ 14	11 40	+1·52	+1·59	16 59 30	196 53 45	0		N.	19·31	0 32 7	19·40	0 32 49
„ 21	11 35	+1·54	+1·59	17 0 20	196 53 17	0		D.	19·50	0 33 26		
„ 28	11 27	+1·52	+1·64	17 0 0	196 53 40	0		N.	19·37	0 32 38		
FEB. 4	11 36	+1·54	+1·61	16 59 42	196 53 30	0		D.	19·36	0 32 34		
„ 11	11 36	+1·52	+1·57	17 0 30	196 53 30	0		N.	19·48	0 33 23	19·39	0 32 47
„ 18	11 34	+1·52	+1·62	16 59 5	196 53 32	0		V G G.	19·34	0 31 52		
„ 25	11 35	+1·52	+1·62	17 0 30	196 53 30	0		N.	19·39	0 33·19		
MARCH 4	11 28	+1·57	+1·67	17 0 20	196 53 35	0		D.	19·42	0 33 4		
„ 11	11 34	+1·52	+1·64	17 2 0	196 53 40	0		N.	19·54	0 34 38	19·39	0 33 8
„ 18	11 49	+1·52	+1·65	17 1 15	196 54 30	5 E	0·88	D.	19·36	0 32 56		
„ 25	11 32	+1·54	+1·56	16 59 10	196 53 40	0		N.	19·24	0 31 55		
APRIL 1	11 34	+1·52	+1·64	16 57 45	196 52 30	0		D.	19·19	0 31 33		
„ 8	11 33	+1·52	+1·59	17 0 0	196 53 5	0		N.	19·45	0 33 17		
„ 15	11 23	+1·50	+1·61	16 58 30	196 52 40	0		N.	19·27	0 32 9	19·29	0 32 5
„ 22	11 29	+1·57	+1·57	16 59 47	196 52 50	0		N.	19·49	0 33 23		
„ 29	11 29	+1·51	+1·71	16 56 15	196 52 22	0		D.	19·06	0 30 5		
MAY 6	11 38	+1·52	+1·57	16 59 30	196 52 55	0		N.	19·38	0 32 58		
„ 13	11 40	+1·55	+1·61	16 57 10	196 52 30	0		D.	19·19	0 31 2	19·23	0 31 25
„ 20	11 41	+1·56	+1·49	16 57 50	196 52 45	0		N.	19·26	0 31 35		
„ 27	11 37	+1·54	+1·61	16 56 15	196 52 30	0		D.	19·11	0 30 7		
JUNE 3	11 37	+1·52	+1·55	16 55 10	196 52 5	5 W	0·69	N.	19·01	0 29 35		
„ 10	11 42	+1·57	+1·54	16 56 35	196 51 25	0		D.	19·28	0 31 37	19·13	0 30 25
„ 17	11 47	+1·51	+1·64	16 55 50	196 52 30	0		N.	19·00	0 29 38		
„ 25	11 38	+1·56	+1·42	16 57 30	196 53 15	0		D.	19·23	0 30 51		
JULY 1	11 37	+1·52	+1·57	16 57 0	196 52 50	0		N.	19·12	0 30 33		
„ 8	11 34	+1·56	+1·51	16 57 25	196 52 30	5 W	0·84	D.	19·28	0 31 30		
„ 15	11 51	+1·54	+1·59	16 57 47	196 52 55	5 E	0·76	N.	19·16	0 31 9	19·18	0 30 58
„ 22	11 28	+1·54	+1·60	16 56 45	196 52 55	0		D.	19·10	0 30 12		
„ 29	11 37	+1·56	+1·52	16 57 30	196 52 35	0		N.	19·24	0 31 24		
AUG. 5	11 20	+1·51	+1·51	16 56 50	196 52 25	0		D.	19·22	0 30 51		
„ 13	11 30	+1·52	+1·62	16 53 55	196 52 7	0		N.	18·91	0 28 7	19·02	0 29 17
„ 19	11 33	+1·52	+1·61	16 56 5	196 51 50	0		D.	19·15	0 30 35		
„ 26	11 26	+1·52	+1·61	16 53 10	196 51 55	0		N.	18·80	0 27 35		
SEPT. 2	11 57	+1·52	+1·59	16 53 50	196 51 55	0		D.	18·89	0 28 17		
„ 9	11 36	+1·52	+1·57	16 55 0	196 52 10	0		N.	18·95	0 29 13		
„ 16	11 45	+1·61	+1·45	16 56 20	196 51 45	12 E	0·73	D.	19·14	0 30 59	19·04	0 29 44
„ 23	11 41	+1·62	+1·45	16 55 15	196 51 50	0		N.	19·11	0 30 2		
„ 30	11 46	+1·51	+1·60	16 55 10	196 51 20	0		D.	19·09	0 30 10		
OCT. 7	11 54	+1·61	+1·46	16 54 30	196 51 45	0		N.	19·01	0 29 21		
„ 14	11 38	+1·51	+1·65	16 55 55	196 51 10	0		D.	19·23	0 31 1	19·15	0 30 46
„ 21	11 29	+1·57	+1·49	16 57 20	196 52 55	10 E	0·87	N.	19·18	0 30 44		
„ 29	11 45	+1·59	+1·55	16 58 10	196 52 40	0		D.	19·20	0 31 59		
NOV. 4	11 38	+1·54	+1·56	16 57 40	196 52 45	0		N.	19·23	0 31 20		
„ 11	11 37	+1·62	+1·55	16 56 15	196 52 20	7 W	0·75	D.	19·16	0 30 33	19·19	0 30 54
„ 18	11 44	+1·59	+1·46	16 57 45	196 53 25	0		N.	19·16	0 30 54		
„ 25	11 42	+1·52	+1·36	16 56 40	196 52 40	10 W	0·78	D.	19·22	0 30 49		
DEC. 2	11 57	+1·59	+1·46	16 59 17	196 53 50	10 E	1·03	N.	19·25	0 31 45		
„ 9	11 50	+1·55	+1·41	16 58 10	196 53 25	0		D.	19·23	0 31 21		
„ 16	11 48	+1·50	+1·62	17 0 15	196 54 30	7 W	1·06	N.	19·35	0 32 14	19·24	0 31 35
„ 23	11 53	+1·56	+1·59	16 58 52	196 53 35	0		D.	19·26	0 31 42		
„ 30	11 42	+1·54	+1·46	16 59 10	196 54 50	0		D.	19·10	0 30 52		

The Mean Declination for the year 1897 = 0° 31 19

Absolute Magnetical Observations.—Table III.

OBSERVATIONS OF INCLINATION, 1897.

Taken with Barrow's Dip Circle, with Microscopes, No. 49 and two 3½-inch Needles, Nos. 1 and 2, by Dover, Charlton.

1897. Date.	Bombay Civil Time (0 to 24 hours). At commencement.	At conclusion.	Observer.	Needle marked.	End of Needle Dipping. A. Face of Circle. East.	A. Face of Circle. West.	B. Face of Circle. East.	B. Face of Circle. West.	Mean Dip.	Monthly Mean for each Needle.	Monthly Mean.
	h. m.	h. m.			° ′	° ′	° ′	° ′	° ′		° ′
JAN. 1	14 58	16 14	G.S.J.	2	22 0·7	20 36·7	20 59·1	19 58·9	20 53·8		
„ 5	12 18	13 40	V.G.G.	2	21 50·6	20 45·5	20 54·7	20 11·1	20 55·5	No. 1	
„ 8	14 56	16 18	D.	1	21 39·2	20 58·7	20 53·1	20 17·7	20 57·2	20° 55′·4	
„ 11	12 27	13 49	N.	1	21 46·0	20 56·9	20 46·1	20 19·0	20 57·0		
„ 15	14 21	15 42	N.	2	21 37·7	20 49·1	21 5·4	20 23·6	20 58·9		20 56·1
„ 19	12 0	13 19	D.	2	21 35·6	20 50·7	21 0·5	20 30·0	20 59·2		
„ 22	14 36	16 2	D.	1	21 35·2	21 4·9	20 36·5	20 24·5	20 55·3	No. 2	
„ 26	12 18	13 38	N.	1	21 36·5	20 59·6	20 44·7	20 8·0	20 52·2	20° 56′·6	
„ 29	14 20	15 43	N.	2	21 16·1	21 8·1	20 22·2	20 56·6	20 55·7		
FEB. 2	12 20	13 42	D.	2	21 11·6	21 17·1	20 26·4	20 53·2	20 57·1		
„ 5	14 19	15 39	D.	1	21 28·1	21 13·0	20 37·6	20 12·0	20 52·7	No. 1	
„ 9	12 17	13 41	N.	1	21 40·4	21 4·9	20 51·9	19 57·6	20 53·7	20° 54′·5	
„ 12	14 38	16 0	N.	2	21 34·1	20 58·2	20 46·6	20 33·2	20 58·0		
„ 16	12 0	13 21	D.	2	21 26·4	20 57·7	20 50·4	20 39·7	20 58·5		20 55·8
„ 19	14 55	16 22	D.	1	21 36·2	21 17·1	20 50·9	19 56·1	20 55·1	No. 2	
„ 23	12 11	13 35	N.	1	21 32·6	21 10·7	20 46·0	20 17·4	20 56·7	20° 57′·1	
„ 26	11 27	14 52	N.	2	21 35·9	20 52·6	20 57·8	20 13·6	20 55·0		
MAR. 2	12 24	15 16	D.	1	21 30·2	20 56·2	20 59·9	20 16·7	20 55·7		
„ 5	12 11	14 47	D.	2	21 22·6	20 55·2	21 1·2	20 29·6	20 57·1	No. 1	
„ 9	12 18	15 8	N.	1	21 21·2	21 7·0	20 52·9	20 27·1	20 57·0	20° 56′·9	
„ 12	13 41	16 19	N.	2	21 21·2	20 58·9	20 54·3	20 34·9	20 57·3		
„ 16	12 10	14 46	D.	1	21 17·9	21 6·4	20 58·6	20 23·9	20 56·7		20 57·3
„ 20	12 35	15 18	D.	2	21 23·1	21 4·1	21 5·1	20 20·4	20 58·2		
„ 23	12 1	14 48	N.	1	21 19·5	21 5·9	20 54·0	20 30·9	20 57·6	No. 2	
„ 26	13 29	15 55	N.	2	21 21·6	21 2·9	20 51·0	20 40·7	20 59·0	20° 57′·9	
„ 30	11 55	14 30	D.	1	21 21·1	21 6·2	20 59·6	20 22·9	20 57·4		
APRIL 2	13 50	16 50	D.	2	21 23·4	21 5·4	20 53·7	20 44·0	21 1·1		
„ 6	11 51	14 24	N.	1	21 17·5	21 2·5	20 56·6	20 28·9	20 56·4	No. 1	
„ 9	13 51	16 30	N.	2	21 16·9	21 2·0	20 56·7	20 42·3	20 59·5	20° 57′·8	
„ 13	11 50	14 34	D.	1	21 18·4	21 16·2	20 48·0	20 30·0	20 58·1		
„ 16	14 30	15 38	N.	2	21 19·6	20 53·4	20 59·7	20 36·4	20 57·3		20 58·6
„ 20	12 15	13 50	D.	2	21 17·6	20 59·7	21 1·1	20 34·7	20 58·3		
„ 23	14 57	16 19	N.	1	21 27·1	20 59·4	20 55·6	20 27·6	20 57·4	No. 2	
„ 27	11 52	13 12	D.	1	21 22·6	21 1·4	21 2·9	20 30·5	20 59·3	20° 59′·2	
„ 30	14 12	15 32	D.	2	21 19·1	21 2·6	20 53·0	20 44·3	20 59·7		

1897. Date.	Bombay Civil Time (0 to 24 hours). At commencement.	At conclusion.	Observer.	Needle marked.	End of Needle Dipping. A. Face of Circle. East.	A. Face of Circle. West.	B. Face of Circle. East.	B. Face of Circle. West.	Mean Dip.	Monthly Mean for each Needle.	Monthly Mean.
	h. m.	h. m.			° ′	° ′	° ′	° ′	° ′		° ′
MAY 4	12 29	13 56	N.	2	21 19·7	20 53·1	21 1·4	20 39·1	20 58·3	No. 1	
,, 7	14 4	15 29	N.	1	21 24·2	21 0·2	20 55·5	20 27·7	20 56·9		
,, 11	11 59	13 18	D.	1	21 18·9	21 4·0	20 56·6	20 29·8	20 57·3	20 58·1	
,, 14	14 46	16 13	D.	2	21 27·1	20 57·1	21 1·4	20 32·7	20 59·6		
,, 18	12 18	13 41	N.	2	21 34·4	20 31·9	21 32·1	20 26·2	21 1·1	No. 2	20 58·9
,, 21	14 30	15 52	N.	1	21 27·7	21 2·6	20 59·0	20 29·4	20 59·7		
,, 25	12 4	13 26	D.	1	21 30·6	21 2·1	20 56·4	20 25·0	20 58·5	20 59·7	
,, 28	14 56	16 22	D.	2	21 25·7	20 55·1	21 3·1	20 35·3	20 59·8		
JUNE 1	12 20	13 47	N.	2	21 22·0	20 55·0	20 58·0	20 38·4	20 58·3	No. 1	
,, 4	14 32	15 49	N.	1	22 29·6	21 5·1	20 58·1	20 32·7	21 1·4		
,, 8	12 4	13 28	D.	1	21 23·1	21 0·0	21 1·6	20 28·0	20 58·2	20 59·2	
,, 11	13 59	15 24	D.	2	21 27·2	20 58·7	21 9·4	20 35·0	21 2·6		
,, 15	12 10	13 35	N.	2	21 23·9	20 54·1	21 3·9	20 35·7	20 59·4		20 59·5
,, 18	14 26	15 49	N.	1	21 28·4	21 0·6	20 59·2	20 28·5	20 59·2	No. 2	
,, 23	12 0	13 25	D.	1	21 28·5	20 59·5	20 58·1	20 25·9	20 58·0		
,, 25	15 0	16 28	D.	2	21 26·4	20 53·0	21 0·1	20 33·3	20 58·2	20 59·7	
,, 29	12 13	13 57	N.	2	21 22·1	20 58·0	21 1·0	20 39·5	21 0·1		
JULY 2	14 35	15 59	N.	1	21 23·1	21 0·8	20 54·6	20 31·0	20 57·4	No. 1	
,, 6	12 12	13 38	D.	1	21 35·7	20 53·9	20 57·2	20 22·0	20 57·0		
,, 9	13 52	15 17	D.	2	21 25·7	20 55·5	21 1·9	20 30·3	20 58·3	20 57·2	
,, 13	12 22	13 47	N.	2	21 24·6	20 55·0	21 1·1	20 35·9	20 59·1		
,, 16	14 39	16 13	N.	1	21 32·9	20 51·6	21 8·5	20 12·7	20 56·4		20 58·3
,, 20	12 3	13 49	D.	1	21 33·9	20 53·4	21 0·5	20 24·7	20 58·1	No. 2	
,, 23	14 46	16 24	D.	2	21 28·2	20 57·1	20 58·6	20 41·6	21 1·4		
,, 27	12 16	13 47	N.	2	21 26·9	20 50·6	21 3·2	20 39·0	20 59·9	20 59·7	
,, 30	14 34	15 58	N.	1	21 25·5	20 58·6	20 57·0	20 27·5	20 57·1		
AUG. 3	12 39	14 9	D.	1	21 32·7	21 1·1	20 57·7	20 23·7	20 58·8	No. 1	
,, 6	14 26	15 52	D.	2	21 24·6	20 53·7	21 7·5	20 37·1	21 0·7		
,, 10	12 21	13 54	N.	2	21 20·9	20 57·0	20 54·9	20 40·5	20 58·3	20 59·2	
,, 13	14 46	16 16	N.	1	21 24·6	21 5·7	20 55·2	20 30·4	20 59·0		
,, 17	12 35	14 1	D.	1	21 31·6	20 55·6	21 3·7	20 19·4	20 57·6		20 59·4
,, 21	14 32	15 49	D.	2	21 31·5	20 51·0	21 11·4	20 26·7	21 0·1	No. 2	
,, 24	12 17	13 45	N.	2	21 27·4	20 54·6	21 2·9	20 35·2	21 0·0		
,, 27	14 42	15 59	N.	1	21 30·1	21 3·1	21 0·2	20 27·8	21 0·3	20 59·8	
,, 30	12 38	14 4	D.	1	21 35·0	20 57·4	21 8·7	20 19·4	21 0·1		

1897. Date.	Bombay Civil Time (0 to 24 hours). At commencement.	At conclusion.	Observer.	Needle marked.	End of Needle Dipping. A. Face of Circle East.	A. Face of Circle West.	B. Face of Circle. East.	B. Face of Circle. West.	Mean Dip.	Monthly Mean for each Needle.	Monthly Mean.
	h. m.	h. m.			° ′	° ′	° ′	° ′	° ′		° ′
SEPT. 3	15 6	16 33	D.	2	21 33·7	20 48·0	21 1·0	20 51·6	21 3·6		
„ 7	12 19	13 43	N.	2	21 32·7	20 49·9	21 8·1	20 25·7	20 59·1		
„ 10	14 30	15 55	N.	1	21 35·4	21 3·4	21 0·6	20 25·1	21 1·1	No. 1	
„ 14	12 34	14 12	D.	1	21 29·7	20 55·0	21 10·7	20 19·2	20 58·6	20 59·5	21 0·1
„ 17	15 23	16 44	D.	2	21 36·2	20 48·4	21 16·6	20 23·1	21 1·1		
„ 21	12 20	13 46	N.	2	21 33·0	20 49·9	21 11·2	20 23·7	20 59·4	No. 2	
„ 24	14 40	16 10	N.	1	21 37·4	20 57·1	21 1·6	20 20·7	20 59·2	21 0·8	
„ 28	12 45	14 19	D.	1	21 40·1	20 52·9	21 2·2	20 21·1	20 59·1		
OCT. 1	14 10	15 21	D.	2	21 41·0	20 49·5	21 18·3	20 26·7	21 3·9		
„ 4	12 10	13 40	N.	2	21 32·1	20 53·1	21 8·4	20 30·9	21 1·1		
„ 8	14 30	16 0	N.	1	21 38·1	20 56·0	21 3·1	20 22·4	20 59·9	No. 1	
„ 12	12 11	13 37	D.	1	21 36·7	20 53·0	21 9·1	20 21·2	21 0·0	20 59·8	
„ 15	14 28	15 49	N.	2	21 27·1	20 53·4	21 8·0	20 29·2	20 59·4		21 0·8
„ 19	12 24	13 48	N.	2	21 38·2	20 51·5	21 12·0	20 25·0	21 1·7		
„ 22	14 33	16 0	N.	1	21 39·4	20 56·6	21 1·2	20 19·0	20 59·0	No. 2	
„ 27	12 3	13 29	D.	1	21 38·7	20 50·2	21 15·5	20 17·2	21 0·4	21 1·6	
„ 29	14 53	16 13	D.	2	21 34·2	20 48·0	21 21·0	20 24·0	21 1·8		
NOV. 2	12 33	13 55	N.	2	21 38·1	20 45·2	21 21·1	20 17·9	21 0·6		
„ 5	14 40	16 10	N.	1	21 45·1	20 47·5	21 14·4	20 17·4	21 1·1		
„ 9	12 13	13 41	D.	1	21 44·4	20 48·7	21 12·5	20 20·5	21 1·5	No. 1	
„ 12	14 35	16 0	D.	2	21 41·2	20 45·0	21 17·4	20 18·5	21 0·5	21 2·3	
„ 16	12 23	13 54	N.	2	21 40·5	20 46·2	21 20·4	20 24·4	21 2·9		21 1·8
„ 19	14 34	16 0	N.	1	21 49·0	20 52·0	21 14·0	20 18·9	21 3·5		
„ 23	12 28	13 56	D.	1	21 45·2	20 51·8	21 20·4	20 14·5	21 3·0	No 2	
„ 26	14 35	16 2	D.	2	21 40·0	20 45·2	21 12·8	20 25·1	21 0·8	21 1·5	
„ 30	12 30	14 10	N.	2	21 37·4	20 46·5	21 21·7	20 24·9	21 2·6		
DEC. 3	14 36	16 7	N.	1	21 42·9	20 50·2	21 13·5	20 21·1	21 1·9		
„ 7	12 31	13 55	D.	1	21 41·9	20 57·6	21 10·5	20 20·2	21 2·5	No. 1	
„ 10	14 35	16 0	D.	2	21 31·0	20 53·2	21 21·5	20 26·2	21 3·0	21 3·2	
„ 14	12 28	13 55	N.	2	21 39·5	20 43·2	21 19·1	20 24·2	21 1·5		
„ 17	14 33	16 4	N.	1	21 44·5	20 49·7	21 17·4	20 20·2	21 2·9		21 3·0
„ 21	12 19	13 51	D.	1	21 44·2	20 55·4	21 20·0	20 25·2	21 6·2		
„ 25	14 31	15 55	D.	2	21 40·6	20 47·1	21 18·7	20 28·2	21 3·6	No. 2	
„ 28	12 31	13 52	N.	2	21 38·9	20 45·0	21 21·9	20 24·4	21 2·5	21 2·6	
„ 31	15 0	16 16	G.S.J.	1	21 40·5	20 51·9	21 15·6	20 22·6	21 2·6		

The Mean Dip for the year ... { With Needle No. 1 = 20 58·6 ; With Needle No. 2 = 20 59·7 }

The Mean Dip for the year 1897 = 20 59·1

Absolute Magnetical Observations.—Table III *a*.

SUPPLEMENTARY OBSERVATIONS OF INCLINATION, 1897.

Taken with Barrow's Dip Circle, with Microscopes, No. 49 and six 3½-inch Needles, viz.:—

with No. $\frac{2}{81}$ by John Dover from January 1 to February 16.
„ No. 5 by Adie from January 8 to February 23.
„ No. 1 by Dover, Charlton from February 26 to April 9.
„ No. 2 by „ „ from March 2 to April 6.
„ No. 1 by „ from April 16 to December 28.
„ No. 2 by „ from April 13 to December 31.

Needles No. $\frac{2}{81}$ and No. 5 were used as supplementary needles as no better needles were in stock. Their results were not found quite satisfactory and therefore on the receipt of new needles, the old ones were replaced by new ones.

Taken with new (Dover, Charlton's) Dip Circle with Microscopes, No. 110 and two 3½-inch Needles, viz.:—*

with No. 3 by Dover from March 5 to April 6.
„ No. 4 „ February 26 to April 9.

1897. Date.	Bombay Civil Time (0 to 24 hours). At commencement. h.	m.	At conclusion. h.	m.	Observer.	Needle marked.	End of Needle Dipping. A. Face of Circle. East. °	′	A. West. °	′	B. Face of Circle. East. °	′	B. West. °	′	Mean Dip. °	′	Mean for each Needle.	Monthly Mean. °	′
JAN. 1	14	7	17	21	G.S.J.	$\frac{2}{81}$	20	59·4	20	28·0	21	15·2	20	44·4	20	51·7			
„ 5	11	30	14	31	V.G.G.	$\frac{2}{81}$	20	59·0	20	32·0	21	11·2	20	41·0	20	50·8	No. $\frac{2}{81}$		
„ 8	14	6	17	8	D.	5	22	3·9	21	16·2	20	30·5	19	56·1	20	56·7			
„ 11	11	35	14	43	N.	5	21	19·9	20	58·9	21	16 4	20	14·2	20	57·3	20 52·2	20	54·0
„ 15	13	30	16	36	N.	$\frac{2}{81}$	21	6·2	20	35·7	21	2·4	20	46·9	20	52·8			
„ 19	11	11	14	16	D.	$\frac{2}{81}$	21	7·4	20	35·4	21	5·9	20	54·5	20	55·8	No. 5		
„ 22	13	45	16	55	D.	5	21	35·6	21	2·1	21	1·9	20	6·9	20	56·6			
„ 26	11	28	14	32	N.	5	21	25·2	21	9·2	20	47·7	20	16·6	20	54·7	20 56·3		
„ 29	13	29	16	37	N.	$\frac{2}{81}$	20	44·0	20	42·7	20	52·7	21	0·7	20	50·0			
FEB. 2	11	30	14	31	D.	$\frac{2}{81}$	20	48·4	20	43·5	20	55·2	21	1·9	20	52·2			
„ 5	13	25	16	30	D.	5	21	41·7	21	2·1	20	33·0	20	22·6	20	54·8	No. $\frac{2}{81}$		
„ 9	11	25	14	35	N.	5	21	23·5	21	6·4	20	54·6	20	14·1	20	54·6	20 53·5		
„ 12	13	50	16	55	N.	$\frac{2}{81}$	21	2·9	20	37·0	21	1·4	20	51·8	20	53·3	No. 5		
„ 16	11	7	14	15	D.	$\frac{2}{81}$	20	59·8	20	42·6	21	1·8	20	56·4	20	55·1	20 56·3	20	55·2
„ 19	14	4	17	15	D.	5	21	25·7	21	14·5	21	7·1	20	3·7	20	57·7	No. 1		
„ 23	11	20	14	32	N.	5	21	32·1	21	5·4	20	40·5	20	34·7	20	58·2	20 55·8		
„ 26	10	37	15	43	N.	1	21	47·6	20	59·4	20	53·5	20	2·9	20	55·8	No. 4		
„ „	[12	28	13	45	N.	4	21	7·6	20	50·2	21	0·3	20	46·8	20	56·2]	20 56·2		
MAR. 2	11	45	16	0	D.	2	21	26·0	20	53·1	20	58·2	20	27·1	20	56·1			
„ „	[13	10	14	33	D.	4	21	4·4	20	57·9	20	58·2	20	48·7	20	57·3]	No. 1		
„ 5	11	29	15	31	D.	1	21	32·7	20	57·4	20	53·7	20	23·2	20	56·7			
„ „	[12	50	14	4	D.	3	20	53·2	20	44·9	21	11·5	21	3·2	20	58·2]	20 56·3		
„ 9	11	40	15	49	N.	2	21	20·9	20	55·1	20	54·6	20	42·2	20	58·2	No. 2		
„ „	[12	57	14	30	N.	3	20	48·3	20	39·7	21	19·8	21	7·7	20	58·9]			
„ 12	13	7	16	58	N.	1	21	23·5	21	4·0	20	56·6	20	22·9	20	56·7	20 58·4		
„ „	[14	16	15	40	N.	4	21	10·7	20	55·5	21	12·4	20	34·1	20	58·2]			
„ 16	11	30	15	28	D.	2	21	23·3	21	2·1	21	6·0	20	22·6	20	58 5	With new		
„ „	[12	48	14	8	D.	4	21	4·7	20	59·1	21	11·0	20	41·3	20	59 0]	Circle.	20	57·5
„ 20	11	55	16	1	D.	1	21	13·6	21	11·7	20	59·2	20	18·2	20	55·7	No. 3		
„ „	[13	15	14	39	D.	3	20	44·2	20	42·2	21	18·1	21	10·8	20	58·8]			
„ 23	11	25	15	24	N.	2	21	18·0	21	2·0	20	57·2	20	42·9	21	0·0	20 59·3		
„ „	[12	48	14	12	N.	3	20	48·7	20	46·1	21	23·1	21	7·1	21	1·2]			
„ 26	12	45	16	32	N.	1	21	17·5	21	6·4	20	58·5	20	21·6	20	56·0	No. 4		
„ „	[14	7	15	15	N.	4	21	4·9	20	55·8	21	3·8	20	45 5	20	57·5]			
„ 30	11	14	15	9	D.	2	21	19·1	20	55·5	20	54·5	20	47·6	20	59·2	20 58·0		
„ „	[12	36	13	51	D.	4	21	7·6	20	53·2	21	6·6	20	44·7	20	58·0]			

*From 26th February to 9th April double sets of observations were taken twice a week for the comparison of the old Circle with the new Circle received at the time. The results by the new Circle are bracketed, which give Inclination results by *New Circle* and are not included in the monthly mean. The double sets were then discontinued and subsequently observations of comparison were taken from time to time, the results of which are not entered here, but given alongwith other results in the discussion of the comparison of the two instruments.

1897. Date.	Bombay Civil Time (0 to 24 hours). At commencement.	At conclusion.	Observer.	Needle marked.	End of Needle Dipping. A. Face of Circle. East.	A. Face of Circle. West.	B. Face of Circle. East.	B. Face of Circle. West.	Mean Dip.	Mean for each Needle.	Monthly Mean.
	h. m.	h. m.			° ′	° ′	° ′	° ′	° ′		° ′
April 2	13 10	17 24	D.	1	21 20·2	21 9·2	21 1·0	20 24·2	20 58·6		
„ „	[14 30	16 12	D.	3	20 50·9	20 47·4	21 20·5	21 7·2	21 1·5]	No. 1	
„ 6	11 16	14 58	N.	2	21 16·6	20 54·6	20 55·0	20 46·2	20 58·1	20 58·5	
„ „	[12 35	13 47	N.	3	20 45·7	20 44·6	21 8·4	21 15·2	20 58·5]		
„ 9	13 16	17 7	N.	1	21 21·0	21 7·2	20 53·1	20 31·1	20 58·1	No. 2	
„ „	[14 30	15 42	N.	4	21 13·7	20 54·6	20 59·9	20 51·6	20 59·9]	20 58·3	
„ 13	12 38	13 55	D.	2	21 0·1	20 54·5	21 1·5	20 51·8	20 57·0		20 58·5
„ 16	13 56	16 10	N.	1	21 5·0	20 43·1	21 12·4	20 51·1	20 57·9	With new Circle. No. 3	
„ 20	11 30	14 27	D.	1	21 8·7	20 42·8	21 7·2	20 56·4	20 58·8		
„ 23	14 15	16 59	N.	2	21 7·6	20 44·4	21 13·7	20 48·1	20 58·4	21 0·0 No. 4	
„ 27	11 11	13 49	D.	2	21 7·4	20 46 8	21 15·5	20 49·8	20 59·9	20 59·9	
„ 30	13 29	16 14	D.	1	21 8·9	20 45·1	21 17·7	20 45·6	20 59·3		
May 4	11 57	14 37	N.	1	21 4·0	20 44·1	21 16·2	20 47·2	20 57·9		
„ 7	13 27	16 12	N.	2	21 14·0	20 41·4	21 13·4	20 43·5	20 58·1	No. 1	
„ 11	11 19	14 0	D.	2	21 16·1	20 45·6	21 8·7	20 45·6	20 59·0	20 59·4	
„ 14	14 5	16 56	D.	1	21 11·4	20 41·5	21 21·0	20 46·2	21 0·0		20 59·0
„ 18	11 37	14 30	N.	1	21 7·6	20 40·7	21 49·0	20 25·2	21 0·6	No. 2	
„ 21	13 50	16 41	N.	2	21 12·9	20 39·1	21 15·4	20 46·1	20 58·4	20 58·6	
„ 25	11 20	14 5	D.	2	21 7·5	20 44·7	21 17·5	20 46·2	20 59·0		
„ 28	14 16	17 0	D.	1	21 7·5	20 37·2	21 25·6	20 46·0	20 59·1		
June 1	11 33	14 37	N.	1	21 3·4	20 49·5	21 15·5	20 47·2	20 58·9		
„ 4	13 51	16 39	N.	2	21 1·5	20 32·1	21 28·7	20 55·0	20 59·3		
„ 8	11 21	14 9	D.	2	21 2·3	20 38·7	21 22·2	20 49·9	20 58·3	No. 1	
„ 11	13 16	16 13	D.	1	20 56·9	20 55·9	21 20·7	20 53·0	21 1·6	20 59·3	
„ 15	11 27	14 15	N.	1	21 3·4	20 44·7	21 17·4	20 48·7	20 58·5		20 58·7
„ 18	13 41	16 32	N.	2	21 3·7	20 42·1	21 23·0	20 40·4	20 57·3	No. 2	
„ 23	11 15	14 15	D.	2	21 3·1	20 34·5	21 25·2	20 44·0	20 56·7	20 57·9	
„ 25	14 14	17 6	D.	1	21 9·7	20 43·2	21 15·5	20 46·7	20 58·8		
„ 29	11 25	14 42	N.	1	21 8·7	20 41·7	21 30·4	20 34·9	20 58·9		
July 2	13 49	16 33	N.	2	21 7·0	20 34·2	21 20·1	20 41·7	20 55·7		
„ 6	11 29	14 20	D.	2	21 9·8	20 39·8	21 17·3	20 46·3	20 58·3		
„ 9	13 14	16 2	D.	1	21 4·7	20 42·5	21 29·9	20 33·6	20 57·7	No. 1	
„ 13	11 34	14 36	N.	1	21 5·6	20 44·0	21 22·7	20 42·5	20 58·7	20 59·2	
„ 16	13 50	16 50	N.	2	21 11·9	20 39·0	21 18·6	20 32·4	20 55·5		20 58·0
„ 20	11 20	14 31	D.	2	21 10·4	20 40·7	21 23·7	20 40·2	20 58·7	No. 2	
„ 23	13 59	17 10	D.	1	21 9·6	20 49·8	21 19·5	20 46·4	21 1·3	20 57·0	
„ 27	11 30	14 34	N.	1	21 8·0	20 40·2	21 22·0	20 46 7	20 59·2		
„ 30	13 42	16 44	N.	2	21 12·0	20 33·2	21 23·6	20 39·1	20 57·0		

1897. Date.	Bombay Civil Time (0 to 24 hours). At commencement.	At conclusion.	Observer.	Needle marked.	End of Needle Dipping. A. Face of Circle. East.	A. Face of Circle. West.	B. Face of Circle. East.	B. Face of Circle. West.	Mean Dip.	Mean for each Needle.	Monthly Mean.
	h. m.	h. m.			° ′	° ′	° ′	° ′	° ′		° ′
Aug. 3	11 39	14 52	D.	2	21 24·0	20 31·5	21 22·4	20 37·9	20 58·9		
„ 6	13 41	16 33	D.	1	21 12·2	20 39·4	21 25·8	20 44·0	21 0·3	No. 1	
„ 10	11 41	14 38	N.	1	21 3·1	20 49·9	21 18·7	20 47·7	20 59·8	° ′	
„ 13	13 55	16 59	N.	2	21 24·2	20 41·5	21 7·4	20 41·6	20 58·7	21 0·3	
„ 17	11 49	14 46	D.	2	21 16·5	20 32·5	21 10·0	20 47·2	20 56·5		20 59·1
„ 21	13 49	16 29	D.	1	21 13·5	20 39·5	21 32·0	20 42·4	21 1·8	No. 2	
„ 24	11 35	14 30	N.	1	21 15·5	20 41·8	21 23·6	20 37·0	20 59·5	° ′	
„ 27	14 7	16 42	N.	2	21 21·4	20 26·0	21 33·1	20 28·1	20 57·1	20 58·0	
„ 30	11 55	14 51	D.	2	21 28·1	20 19·0	21 32·2	20 36·7	20 59·0		
Sept. 3	14 20	17 16	D.	1	21 21·5	20 36·7	21 33·7	20 37·6	21 2·4	No. 1	
„ 7	11 40	14 29	N.	1	21 12·6	20 37·4	21 27·5	20 30·0	20 56·9	° ′	
„ 10	13 47	16 38	N.	2	21 30·9	20 21·4	21 32·0	20 26·5	20 57·7	20 59·1	
„ 14	11 49	14 53	D.	2	21 27·8	20 25·2	21 25·0	20 25·0	20 55·7		20 58·2
„ 17	14 35	17 24	D.	1	21 23·7	20 36·6	21 21·6	20 32·1	20 58·5	No. 2	
„ 21	11 43	14 29	N.	1	21 25·6	20 26·1	21 34·0	20 29·7	20 58·8	° ′	
„ 24	13 58	16 48	N.	2	21 31·0	20 22·4	21 34·4	20 25·9	20 58·4	20 57·2	
„ 28	11 54	15 0	D.	2	21 27·0	20 27·9	21 28·2	20 25·6	20 57·2		
Oct. 1	13 29	16 3	D.	1	21 23·7	20 25·5	21 41·5	20 37·1	21 1·9		
„ 4	11 32	14 18	N.	1	21 15·6	20 35·5	21 42·0	20 38·2	21 2·8	No. 1	
„ 8	13 50	16 39	N.	2	21 33·0	20 19·0	21 37·7	20 25·1	20 58·7	° ′	
„ 12	11 29	14 16	D.	2	21 31·5	20 24·6	21 30·7	20 24·5	20 57·8	21 2·1	
„ 15	13 45	16 33	N.	1	21 15·9	20 31·0	21 44·2	20 27·2	20 59·6		21 0·4
„ 19	11 40	14 33	N.	1	21 26·7	20 35·2	21 41·0	20 29·6	21 3·1	No. 2	
„ 22	13 48	16 42	N.	2	21 34·4	20 13·9	21 41·7	20 24·6	20 58·6	° ′	
„ 27	11 21	14 10	D.	2	21 28·2	20 20·1	21 37·0	20 29·1	20 58·6	20 58·4	
„ 29	14 10	16 53	D.	1	21 26·9	20 38·5	21 34·7	20 31·5	21 2·9		
Nov. 2	11 45	14 41	N.	1	21 29·9	20 26·0	21 54·7	20 10·4	21 0·2		
„ 5	13 50	16 52	N.	2	21 46·4	20 9·1	21 54·9	20 14·1	21 1·1	No. 1	
„ 9	11 31	14 26	D.	2	21 42·7	20 20·2	21 45·9	20 18·8	21 1·9	° ′	
„ 12	13 55	16 41	D.	1	21 28·4	20 27·9	21 51·7	20 11·6	20 59·9	21 1·2	
„ 16	11 35	14 36	N.	1	21 31·0	20 27·7	21 44·4	20 26·5	21 2·4		21 0·9
„ 19	13 49	16 41	N.	2	21 39·7	20 13·5	21 47·4	20 23·0	21 0·9	No. 2	
„ 23	11 32	14 39	D.	2	21 36·8	20 15·6	21 42·0	20 21·0	20 58·8	° ′	
„ 26	13 55	16 41	D.	1	21 28·0	20 34·1	21 37·2	20 22·7	21 0·5	21 0·7	
„ 30	11 46	14 50	N.	1	21 31·0	20 26·6	21 54·2	20 19·4	21 2·8		
Dec. 3	13 51	16 48	N.	2	21 47·0	20 7·4	21 54·1	20 18·2	21 1·7		
„ 7	11 39	14 38	D.	2	21 42·6	20 15·0	21 51·3	20 19·7	21 2·1	No. 1	
„ 10	13 55	16 40	D.	1	21 23·1	20 29·8	21 54·0	20 24·4	21 2·8	° ′	
„ 14	11 47	14 37	N.	1	21 28·5	20 24·0	21 47·0	20 23·9	21 0·8	21 2·3	
„ 17	13 52	16 42	N.	2	21 34·0	20 16·7	21 49·9	20 26·4	21 1·7		21 2·6
„ 21	11 39	14 34	D.	2	21 31·0	20 22·9	21 51·6	20 32·0	21 4·4	No. 2	
„ 25	13 51	16 40	D.	1	21 30·9	20 26·2	21 48·2	20 25 5	21 2·7	° ′	
„ 28	11 50	14 33	N.	1	21 30 6	20 26·5	21 49·5	20 25·7	21 3·1	21 2·9	
„ 31	14 15	16 58	G.S.J.	2	21 34·2	20 25·5	21 42·7	20 35·6	21 4·5		

The Mean Dip for the year 1897 = 20° 58′·5

he yearly means for each needle are not given as the period for each is incomplete.

APPENDIX.

LIBRARY OF THE BOMBAY BRANCH OF THE ROYAL ASIATIC SOCIETY

APPENDIX.

HOURLY MEANS OF DECLINATION AND HORIZONTAL FORCE.

(AS DETERMINED FROM SELECTED QUIET DAYS)

FOR THE YEARS

1894—1895—1896—1897.

WHILE continuing the usual process adopted in this Observatory for obtaining the diurnal variation, Tables IV to XIII give the results of the magnetograph curves standardised by absolute observations, on lines suggested by the Committee of the British Association. The selected quiet days suitable for the determination of diurnal variation are the same as those selected for the years by the Astronomer Royal. Table I shows the disturbance days of the year 1897. Tables II and III give the mean values for 1894, 1895, 1896 and 1897 of Declination and Horizontal Force respectively as determined by several different processes. Tables IV and V give the hourly means and the diurnal inequality of Declination for the year 1897, those for the years 1894, 1895 and 1896 being already published in the last volume. Tables VI to XIII give hourly means and the diurnal inequalities of Horizontal Force for the years 1894, 1895, 1896 and 1897. Similar results of Vertical Force from the year 1894 will appear in the next volume.

TABLE I.—*Dates of Magnetic Disturbances, 1897.*

1897. Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1	M.	S.	S.	S.	C.	C.	C.	M.	C.	S.	M.	S.
2	G.	S.	S.	S.	M.	S.	C.	C.	C.	S.	S.	C.
3	M.	M.	S.	S.	S.	S.	C.	C.	C.	S.	C.	C.
4	C.	M.	M.	S.	S.	S.	C.	C.	S.	C.	S.	S.
5	S.	S.	S.	S.	S.	C.	C.	C.	S.	C.	S.	S.
6	C.	S.	S.	S.	S.	C.	C.	C.	C.	C.	C.	C.
7	S.	S.	S.	S.	C.	C.	C.	C.	C.	C.	C.	S.
8	C.	S.	S.	S.	S.	C.	C.	C.	C.	C.	C.	C.
9	C.	S.	S.	S.	S.	C.	C.	S.	C.	S.	S.	S.
10	S.	S.	S.	S.	S.	C.	S.	C.	S.	S.	S.	S.
11	M.	S.	S.	S.	S.	S.	C.	C.	S.	S.	S.	C.
12	S.	S.	S.	S.	C.	C.*	C.	C.	S.	S.	C.	S.
13	S.	S.	S.	S.	S.	C.	C.	C.	S.	C.	C.	C.
14	S.	M.	S.	S.	M.	C.	S.	C.	S.	C.	S.	C.
15	S.	S.	S.	S.	S.	S.	C.	S.	C.	S.	S.	M.
16	S.	S.	S.	S.	C.	S.	C.	C.	C.	S.	C.	S.
17	S.	C.	S.	S.	M.	S.	C.	C.	C.	S.	M.	M.
18	S.	C.	C.	S.	C.	S.	C.	C.	S.	S.	S.	S.
19	S.	C.	S.	M.	S.	S.	C.	S.	C.	S.	C.	S.
20	C.	S.	C.	G.	S.	S.	C.	S.	C.	C.	S.	V.G.
21	C.	S.	C.	C.	M.	S.	S.	C.	S.†	C.	C.	M.
22	C.	S.	S.	S.	S.	S.	C.	C.	C.	S.	C.	S.
23	S.	S.	S.	M.	S.	C.	C.	C.	S.	S.	S.	C.
24	C.	S.	S.	M.	C.	C.	C.	C.	C.	S.	M.	S.
25	S.	M.	C.	M.	C.	C.	C.	S.	C.	S.	S.	C.
26	C.	S.	S.	S.	C.	S.	C.	C.	C.	S.	S.	C.
27	S.	M.	S.	S.	C.	S.	C.	S.	C.	S.	S.	C.
28	M.	M.	S.	C.	C.	C.	C.	C.	C.	S.	C.	C.
29	M.		S.	C.	S.	C.	C.	C.	C.	S.	S.	S.
30	S.		S.	C.	M.	C.	S.	S.	C.	S.	C.	S.
31	S.		C.		C.		S.	C.		S.		M.
Totals ... C.	9	3	5	4	11	16	26	23	20	9	12	11
Totals ... S.	16	19	25	21	15	14	5	7	10	22	15	14
Totals ... M.	5	6	1	4	5	0	0	1	0	0	3	4
Totals ... G.	1	0	0	1	0	0	0	0	0	0	0	1
Totals ... V.G.	0	0	0	0	0	0	0	0	0	0	0	1

Disturbances are determined from Horizontal Force traces.
C.=calm ; S =small; M. = moderate ; G.=great ; V.G. = very great.
Days are reckoned from 10 A.M. to 10 A.M. of the following day.
* Vibration due to Assam Earthquake. † Vibration due to Borneo Earthquake.

TABLE II.—*Declination.*

Description of Process.	1894.	1895.	1896.	1897.
	′ ″	′ ″	′ ″	′ ″
(1) Yearly mean obtained from selected quiet days by constants determined from month to month ...	39 26	37 5	34 50	32 35
(2) Yearly mean obtained from all (unrestricted) days by constants determined from month to month ...	39 35	37 9	34 55	32 41
(3) Yearly mean obtained from selected quiet days determined by a single constant	39 26	37 1	35 3	32 24
(4) Yearly mean obtained from all (unrestricted) days determined by a single constant	39 35	37 6	35 9	32 29
(5) Yearly mean(Absolute observed reduced to the monthly mean tabulation of Magnetograph)	39 34	37 8	34 54	32 40

TABLE III.—*Horizontal Force.*

Description of processes.	1894.	1895.	1896.	1897.
	C.G.S.	C.G.S.	C.G.S.	C.G.S.
(1) Yearly mean obtained from selected quiet days by constants determined from month to month ...	·37413	·37425	·37446	·37449
(2) Yearly mean obtained from all (unrestricted) days by constants determined from month to month ...	·37400	·37418	·37438	·37444
(3) Yearly mean (Absolute observed reduced to the monthly mean reading of Grubb's) ...	·37406	·37424	·37441	·37444
(4) Yearly mean (Absolute observed reduced to the monthly mean tabulation of Magnetograph)	·37408	·37427	·37444	·37449

TABLE IV.—Hourly Means of the Declination, as determined from the selected quiet days in 1897.

(*The Mean for the year* = 0° 32′·6 *East.*)

Hours.	Preceding noon.	Mid.	1	2	3	4	5	6	7	8	9	10	11	Noon.	1	2	3	4	5	6	7	8	9	10	11	Mid.	Succeeding noon.
WINTER.																											
1897. Months.	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′
January	32·7	33·7	33·7	33·7	33·5	33·4	33·3	33·2	33·4	34·5	34·2	33·7	32·5	32·2	32·8	33·3	33·9	34·1	33·7	33·5	33·6	33·5	33·5	33·6	33·6	33·6	32·5
February ...	32·6	33·5	33·5	33·4	33·3	33·2	33·1	33·1	33·2	33·8	33·9	33·6	32·8	32·7	32·9	33·4	33·9	34·0	33·6	33·3	33·4	33·4	33·4	33·4	33·4	33·5	32·5
March ...	3·*7	33·3	33·3	33·4	33·3	33·3	33·3	33·1	33·7	34·4	34·4	34·1	33·3	32·6	32·4	32·8	33·5	33·8	33·4	33·1	33·1	33·1	33·2	33·2	33·3	33·3	32·4
October ...	30·6	32·1	32·1	32·0	31·9	31·8	32·0	32·2	32·9	33·0	32·3	31·8	31·0	30·7	31·2	31·9	32·4	32·4	32·0	31·9	32·0	32·0	32·0	32·0	32·2	32·2	30·8
November ...	31·8	32·1	32·0	31·9	31·7	31·6	31·6	31·3	31·3	31·7	31·9	31·9	31·5	31·7	32·2	32·3	32·1	32·0	31·8	31·9	31·9	31·9	31·8	31·9	32·0	32·0	32·0
December ...	31·3	31·3	31·3	31·1	31·0	30·8	30·7	30·8	30·7	31·3	31·7	31·6	30·9	30·6	31·0	31·4	31·6	31·5	31·2	31·2	31·2	31·1	31·0	31·0	31·1	31·1	30·9
Means ...	31·9	32·7	32·6	32·6	32·5	32·4	32·3	32·3	32·5	33·1	33·1	32·8	32·0	31·8	32·1	32·5	32·9	33·0	32·6	32·5	32·5	32·5	32·5	32·5	32·6	32·6	31·9
SUMMER.																											
	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′
April ...	32·9	34·0	34·0	34·1	34·0	33·9	33·9	34·4	35·2	35·5	35·4	34·8	33·5	32·6	32·3	32·4	33·0	33·5	33·5	33·5	33·3	33·3	33·4	33·5	33·6	33·7	32·3
May ...	30·9	33·4	33·5	33·5	33·5	33·5	33·8	34·9	35·5	35·5	34·5	33·3	32·0	31·3	31·4	32·1	32·7	33·2	33·4	33·2	32·9	32·9	32·9	33·1	33·2	33·3	31·4
June ...	31·4	32·7	32·8	32·8	32·9	32·9	33·2	34·1	34·4	34·3	33·6	32·4	31·2	30·6	30·7	31·2	31·8	32·4	32·6	32·4	32·2	32·1	32·2	32·4	32·6	32·7	31·0
July ...	30·0	32·2	32·3	32·4	32·4	32·5	32·8	33·8	34·0	33·8	33·0	31·5	30·2	29·7	29·9	30·5	31·2	31·8	32·0	32·0	31·7	31·6	31·8	31·9	32·0	32·2	30·3
August ...	30·6	32·8	32·9	32·9	32·8	32·8	33·0	33·7	34·5	34·5	33·6	32·6	31·8	30·6	30·6	31·1	31·6	32·2	32·5	32·6	32·3	32·2	32·3	32·4	32·5	32·6	30·3
September ...	29·7	31·9	32·0	31·9	31·9	31·9	32·1	32·8	33·6	33·4	32·4	31·4	30·8	29·8	30·2	31·1	31·7	32·1	31·9	31·5	31·3	31·3	31·4	31·4	31·6	31·7	29·9
Means ...	30·9	32·8	32·9	32·9	32·9	32·9	33·1	33·9	34·5	34·5	33·7	32·7	31·4	30·8	30·8	31·4	32·0	32·5	32·7	32·5	32·3	32·2	32·3	32·5	32·6	32·7	30·9

TABLE V.—Diurnal Inequality of the Declination at Colaba as derived from Table IV.

Hours.	Mid.	1	2	3	4	5	6	7	8	9	10	11	Noon.	1	2	3	4	5	6	7	8	9	10	11	Mid.
SUMMER MEANS.																									
	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′
	+0·2	+0·3	+0·3	+0·3	+0·3	+0·5	+1·3	+1·9	+1·9	+1·1	0·0	−1·2	−1·8	−1·8	−1·2	−0·6	−0·1	0·0	−0·1	−0·4	−0·4	−0·3	−0·2	0·0	+0·1
WINTER MEANS.																									
	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′
	+0·1	+0·1	0·0	−0·1	−0·1	−0·2	−0·2	0·0	+0·6	+0·5	+0·3	−0·5	−0·8	−0·4	0·0	+0·4	+0·4	+0·1	0·0	0·0	0·0	0·0	0·0	0·0	0·0	+0·1
ANNUAL MEANS.																									
	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′
	+0·2	+0·2	+0·2	+0·1	+0·1	+0·1	+0·5	+1·0	+1·2	+0·8	+0·1	−0·9	−1·3	−1·1	−0·6	−0·1	+0·2	+0·1	−0·1	−0·2	−0·2	−0·2	−0·1	0·0	+0·1

Note.—When the sign is + the magnet points to the East of its mean position.

TABLE VI.—**Hourly Means of the Horizontal Force in C. G. S. units (corrected for temperature) as determined from the selected quiet days in 1894.**

(*The Mean for the year*=0·37413)

Hours.	Preceding noon.	Mid.	1	2	3	4	5	6	7	8	9	10	11	Noon.	1	2	3	4	5	6	7	8	9	10	11	Mid.	Succeeding noon.
	0·37000+																										
WINTER.																											
1894. Months.																											
January ...	440	396	398	400	398	395	396	401	405	415	428	439	446	445	438	429	423	416	412	410	406	404	402	402	403	402	438
February ...	421	380	381	381	382	385	387	390	397	412	425	409	441	442	432	417	414	404	400	399	397	395	394	393	390	394	446
March ...	440	391	392	392	391	391	393	394	403	401	436	451	455	450	438	426	418	409	406	403	401	399	396	393	394	394	464
October ...	447	392	394	395	397	396	393	395	398	411	428	449	456	455	441	426	417	411	405	405	401	398	396	396	396	396	460
November ...	446	411	410	411	411	411	413	418	428	440	453	465	471	461	446	437	427	420	416	414	412	412	412	414	415	416	460
December ...	441	421	418	417	420	420	421	423	428	436	442	448	450	448	444	439	436	427	425	425	425	424	425	424	424	424	462
Means ...	439	398	398	399	400	400	400	403	410	419	435	443	453	450	440	429	422	414	411	409	407	405	404	404	404	404	455
SUMMER.																											
April	432	382	381	380	380	381	380	383	389	402	422	439	440	437	423	411	404	399	394	391	389	386	384	384	385	385	448
May	405	409	409	407	406	407	410	413	419	439	456	443	469	465	456	444	432	423	420	418	415	413	412	411	410	410	454
June	403	411	412	412	412	413	412	419	431	440	457	472	476	474	464	452	437	426	415	410	414	415	413	413	416	415	468
July	428	384	385	387	388	390	391	395	402	412	426	439	441	438	431	421	410	402	397	397	397	394	394	394	394	394	439
August ...	433	389	389	390	390	389	391	394	398	410	425	440	443	443	435	428	416	404	396	396	395	392	393	394	393	390	447
September ...	437	393	392	393	392	393	393	392	393	403	421	434	439	437	430	420	414	407	402	402	398	395	392	392	394	395	453
Means ...	443	395	395	395	395	395	396	399	405	418	434	444	451	449	440	429	419	410	404	402	401	399	398	398	399	398	451

TABLE VII.—**Diurnal Inequality of the Horizontal Force at Colaba as deduced from Table VI.**

Hours.	Mid.	1	2	3	4	5	6	7	8	9	10	11	Noon.	1	2	3	4	5	6	7	8	9	10	11	Mid.
SUMMER MEANS.																									
	−·00016	−·00016	−·00016	−·00016	−·00016	−·00015	−·00012	−·00006	+·00007	+·00028	+·00033	+·00040	+·00038	+·00029	+·00018	+·00008	−·00001	−·00007	−·00009	−·00010	−·00012	−·00013	−·00013	−·00013	−·00013
WINTER MEANS.																									
	−·00017	−·00017	−·00016	−·00015	−·00015	−·00015	−·00012	−·00005	+·00004	+·00020	+·00028	+·00038	+·00035	+·00025	+·00014	+·00007	−·00001	−·00004	−·00006	−·00008	−·00010	−·00011	−·00011	−·00011	−·00011
ANNUAL MEANS.																									
	−·00016	−·00016	−·00016	−·00016	−·00015	−·00015	−·00012	−·00005	+·00005	+·00022	+·00031	+·00039	+·00037	+·00027	+·00016	+·00008	−·00001	−·00006	−·00007	−·00009	−·00011	−·00012	−·00012	−·00012	−·00012

Note.—When the sign is + the reading is above the mean.

TABLE VIII.—**Hourly Means of the Horizontal Force in C. G. S. units (corrected for temperature) as determined from the selected quiet days in 1895.**

(*The Mean for the year* = 0·37425)

Hours.	Preceding noon.	Mid.	1	2	3	4	5	6	7	8	9	10	11	Noon.	1	2	3	4	5	6	7	8	9	10	11	Mid.	Succeeding noon
	0·37000 +																										
WINTER.																											
1895. Months.																											
January ...	440	413	409	408	409	410	412	417	425	434	442	449	452	443	434	427	422	416	416	416	416	416	412	413	415	414	447
February ...	430	386	385	388	388	391	392	395	398	412	422	431	435	431	425	416	405	398	394	396	398	399	399	401	401	402	448
March	456	401	399	402	403	403	404	405	413	428	444	455	458	455	470	431	418	412	404	401	402	402	403	403	407	407	470
October... ...	436	406	403	405	404	404	405	407	411	421	436	446	451	447	433	424	415	412	410	411	407	406	405	404	405	407	453
November ...	461	429	434	431	429	427	430	435	446	457	468	473	474	466	457	448	442	438	435	433	433	429	433	431	431	432	471
December ...	462	434	436	436	437	438	439	444	452	464	472	477	474	449	457	451	445	441	440	434	433	433	431	435	438	437	485
Means	447	411	411	412	412	412	414	417	424	436	447	455	457	448	446	433	424	419	416	415	415	414	414	414	416	416	462
SUMMER.																											
April	447	402	400	404	402	403	405	407	414	426	444	455	460	455	449	432	421	417	414	413	409	407	406	409	408	408	464
May	441	402	404	405	405	405	407	416	424	437	450	462	464	463	455	442	430	422	418	415	415	415	416	414	415	414	457
June	470	425	426	425	424	426	426	430	441	457	473	486	491	487	478	465	450	437	430	429	430	430	432	433	434	434	492
July	431	400	407	404	405	405	407	409	421	432	444	454	461	459	451	439	430	417	410	407	408	409	411	411	411	412	464
August	457	412	411	412	413	413	415	417	422	431	444	455	462	461	455	447	437	427	420	418	417	416	416	414	415	414	461
September ...	442	406	402	405	406	405	405	402	402	412	430	446	455	455	449	438	427	419	416	413	409	408	408	407	409	409	464
Means	448	408	408	409	409	409	411	413	421	432	447	460	465	463	456	444	432	423	418	416	415	414	415	415	415	415	467

TABLE IX.—**Diurnal Inequality of the Horizontal Force at Colaba as deduced from Table VIII.**

Hours.	Mid.	1	2	3	4	5	6	7	8	9	10	11	Noon.	1	2	3	4	5	6	7	8	9	10	11	Mid.
SUMMER MEANS.																									
	−·00018	−·00018	−·00017	−·00017	−·00017	−·00015	−·00013	−·00005	+·00006	+·00021	+·00034	+·00039	+·00037	+·00030	+·00018	+·00006	−·00003	−·00008	−·00010	−·00011	−·00012	−·0001	−·00011	−·00011	−·00011
WINTER MEANS.																									
	−·00013	−·00013	−·00012	−·00012	−·00012	−·00010	−·00007	·00000	+·00012	+·00023	+·00031	+·00033	+·00024	+·00022	+·00009	·00000	−·00005	−·00008	−·00009	−·00009	−·00010	−·00010	−·00010	−·00008	−·00008
ANNUAL MEANS.																									
	−·00015	−·00015	−·00015	−·00015	−·00014	−·00013	−·00010	−·00003	+·00009	+·00022	+·00032	+·00036	+·00031	+·00026	+·00013	+·00003	−·00004	−·00008	−·00010	−·00010	−·00011	−·00011	−·00010	−·00009	−·00009

Note.—When the sign is + the reading is above the mean.

TABLE X.—Hourly Means of the Horizontal Force in C. G. S. units (corrected for temperature) as determined from the selected quiet days in 1896.

(*The Mean for the year*=0·37446.)

Hours.	Preceding noon.	Mid.	1	2	3	4	5	6	7	8	9	10	11	Noon.	1	2	3	4	5	6	7	8	9	10	11	Mid.	Succeeding noon.
	0·37000+																										
																	WINTER.										
1896. Months.																											
January ...	473	443	448	449	444	446	448	450	456	462	465	475	482	480	473	466	458	452	454	450	449	446	445	447	447	448	468
February ...	475	437	440	440	440	441	442	444	447	455	464	472	476	476	472	461	454	451	449	447	447	444	441	436	439	441	486
March ...	464	414	415	416	417	418	420	424	431	445	461	472	475	468	458	449	441	435	432	430	427	424	425	423	424	427	468
October ...	472	429	431	431	429	430	432	432	437	452	469	480	484	480	466	456	446	438	436	435	432	431	430	431	433	434	476
November ...	475	440	440	443	444	443	445	446	455	465	475	483	486	480	470	461	453	447	446	446	446	445	445	445	446	445	477
December ...	466	440	440	442	443	445	446	447	453	459	467	475	475	472	465	457	451	446	444	445	444	445	446	446	447	447	482
Means ...	471	434	436	437	436	437	439	440	446	456	467	476	480	476	467	458	450	445	443	442	441	439	439	438	439	440	476
																	SUMMER.										
April ...	479	431	428	429	432	432	433	436	445	462	479	491	495	491	481	470	461	454	449	447	443	440	439	440	439	440	493
May ...	457	413	413	412	413	415	415	418	427	441	455	468	473	470	464	453	444	434	428	425	425	423	424	425	427	426	461
June ...	469	439	437	436	437	438	440	444	451	460	473	484	485	480	471	464	456	449	445	444	444	443	443	442	443	441	487
July ...	480	433	432	438	435	435	436	439	444	450	459	469	476	480	478	470	459	449	441	438	438	438	438	438	438	439	483
August ...	457	421	422	422	422	423	423	424	426	434	442	449	453	453	449	443	436	432	429	427	426	425	424	423	426	425	466
September ...	480	431	434	434	434	434	435	434	435	443	464	478	483	482	473	461	450	446	443	444	442	439	437	434	438	437	493
Means ...	470	428	428	428	429	429	430	432	438	448	462	473	477	476	469	460	451	444	439	437	436	435	434	434	435	435	480

TABLE XI.—Diurnal Inequality of the Horizontal Force at Colaba as deduced from Table X.

Hours.	Mid.	1	2	3	4	5	6	7	8	9	10	11	Noon.	1	2	3	4	5	6	7	8	9	10	11	Mid.
												SUMMER MEANS.													
	−·00016	−·00016	−·00016	−·00015	−·00015	−·00014	−·00012	−·00006	+·00004	+·00018	+·00029	+·00033	+·00032	+·00025	+·00016	+·00007	·00000	−·00005	−·00007	−·00008	−·00009	−·00010	−·00010	−·00009	−·00009
												WINTER MEANS.													
	−·00014	−·00012	−·00011	−·00012	−·00011	−·00009	−·00008	−·00002	+·00008	+·00019	+·00028	+·00032	+·00028	+·00019	+·00010	+·00002	−·00003	−·00005	−·00006	−·00007	−·00009	−·00009	−·00010	−·00009	−·00008
												ANNUAL MEANS.													
	−·00015	−·00014	−·00013	−·00014	−·00013	−·00011	−·00010	−·00004	+·00006	+·00018	+·00029	+·00033	+·00030	+·00022	+·00013	+·00005	−·00002	−·00005	−·00006	−·00007	−·00009	−·00010	−·00010	−·00009	−·00009

Note.—When the sign is + the reading is above the mean.

Table XII.—Hourly Means of the Horizontal Force in C. G. S. units (corrected for temperature) as determined from the selected quiet days in 1897.

(The Mean for the year = 0·37449.)

Hours.	Preceding noon.	Mid.	1	2	3	4	5	6	7	8	9	10	11	Noon.	1	2	3	4	5	6	7	8	9	10	11	Mid.	Succeeding noon.
c	0·37000+																										
WINTER.																											
1897. Months.																											
January ...	482	445	445	445	446	448	449	452	456	467	477	488	495	492	480	469	461	457	453	451	449	448	448	449	450	449	491
February ...	477	444	446	447	448	448	448	450	452	459	470	481	487	484	476	465	460	455	454	450	449	447	447	444	444	446	484
March ...	476	438	435	436	437	437	437	439	445	456	470	481	485	478	467	457	451	450	448	444	439	438	436	439	438	441	483
October ...	461	440	439	438	437	440	440	441	446	456	466	474	476	473	463	454	450	447	445	444	441	441	440	441	443	442	479
November ...	454	434	433	433	436	437	438	441	452	462	470	474	473	465	455	446	441	436	434	433	434	434	435	434	436	436	462
December ...	445	422	421	424	422	421	422	425	430	440	448	456	461	458	451	443	436	431	429	427	427	427	427	427	428	429	456
Means ...	466	437	436	437	438	438	439	441	447	457	467	476	479	475	465	456	450	446	444	441	440	439	439	439	440	440	476
SUMMER.																											
April ...	442	422	423	424	424	426	427	430	435	450	464	474	477	474	465	456	450	444	439	435	433	430	430	431	433	434	477
May ...	463	433	430	431	431	431	432	434	440	450	461	472	477	476	468	457	449	443	437	434	434	434	435	438	439	438	475
June ...	480	441	444	445	445	446	447	451	459	466	474	483	483	480	477	469	461	453	448	448	448	448	448	448	449	450	482
July ...	479	446	444	445	445	446	446	451	458	466	473	482	485	484	481	472	461	453	450	447	447	448	449	450	450	451	493
August ...	484	447	446	445	447	449	449	450	452	460	471	477	479	479	476	470	461	453	448	445	446	446	448	448	449	450	487
September ...	468	435	432	435	437	437	437	436	442	454	467	471	470	463	458	454	449	444	442	442	441	441	441	442	443	444	474
Means ...	469	438	436	437	438	439	440	442	447	456	466	475	479	477	472	464	456	449	444	442	441	441	441	442	443	444	481

Table XIII.—Diurnal Inequality of the Horizontal Force at Colaba as deduced from Table XII.

Hours.	Mid.	1	2	3	4	5	6	7	8	9	10	11	Noon.	1	2	3	4	5	6	7	8	9	10	11	Mid.
SUMMER MEANS.																									
	—·00012	—·00014	—·00013	—·00012	—·00011	—·00010	—·00008	—·00003	+·00006	+·00016	+·00025	+·00029	+·00027	+·00022	+·00014	+·00006	—·00001	—·00006	—·00008	—·00009	—·00009	—·00009	—·00008	—·00007	—·00006
WINTER MEANS.																									
	—·00012	—·00013	—·00012	—·00011	—·00011	—·00010	—·00008	—·00004	+·00003	+·00018	+·00027	+·00030	+·00026	+·00016	+·00007	+·00001	—·00003	—·00005	—·00008	—·00009	—·00010	—·00010	—·00010	—·00009	—·00009
ANNUAL MEANS.																									
	—·00012	—·00013	—·00012	—·00011	—·00010	—·00010	—·00007	—·00002	+·00007	+·00017	+·00027	+·00030	+·00027	+·00019	+·00011	+·00004	—·00001	—·00005	—·00007	—·00008	—·00009	—·00009	—·00009	—·00008	—·00007

Note.—When the sign is + the reading is above the mean.

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